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INTRODUCTION

Phoenix

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VOL. 10, 1972
NO. 22-24

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IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

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Cumulated index volumes: United States and possessions, $75 postpaid; foreign countries, $90 postpaid.

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Scientific and technical reports produced by NASA and its contractors and grantees, or in conjunction with other Government agencies, and other selected documents released by NASA are identified by an asterisk (*) following the accession numbers (e.g., N72-10748*). Prior to their announcement in *STAR*, these NASA publications are assigned a specific NASA report number, which is shown on the last line of the *STAR* citation. The nature of NASA publications is specified by the report number series, identified by a prefix to the report number: TR-R, TN-D, TM-X, TT-F, CR, or SP. These series refer respectively to NASA Technical Reports, which contain significant and complete contributions to scientific and technical knowledge; Technical Notes, reports of similar quality but lesser scope; Technical Memorandums, reports containing preliminary data or of specialized utility; Technical Translations, information published in a foreign language and considered to merit NASA distribution in English; Contractor Reports, information generated under NASA-sponsored contracts, grants, or interagency agreements; and Special Publications, which include conference proceedings, monographs, data compilations, sourcebooks, special bibliographies, and other publications derived from or of value to NASA activities. Reports in these series that are printed by NASA are often referred to as "low-numbered" or "low series" publications, because the report number is always below 50,000 (8,000 for Technical Translations). Some TM-X and CR reports are numbered above 50,000. These, and TT-F translations above 8,000, are referred to as "high-numbered" or "high series" publications, and are generally available only in microfiche[1] or facsimile reproductions.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: hierarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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02 Aircraft 2910
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 2914
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 2920
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 2923
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 2926
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 2931
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

08 Computers 2938
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 2939
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 2944
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 2946
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 2947
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 2951
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 2965
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15 Machine Elements and Processes 2970
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

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18 Materials, Nonmetallic 2982
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 2985
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2986
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2990
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2992
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

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26 Physics, Solid-State 3002
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28 Propulsion Systems 3007
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29 Space Radiation 3010
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 3012
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 3021
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 3025
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 3029
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

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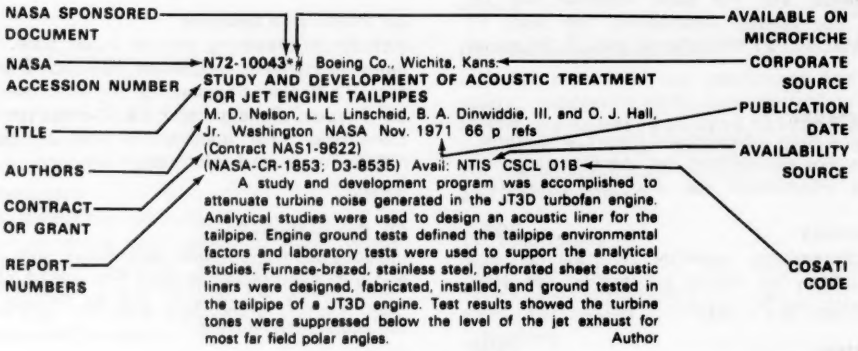

N72-10043*# Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs (Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B

A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

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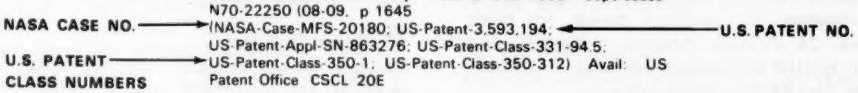
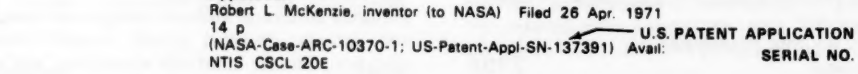


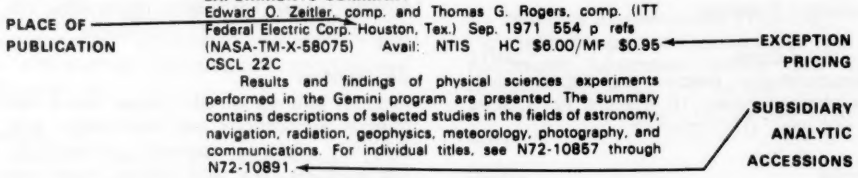
N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA) Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION



N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

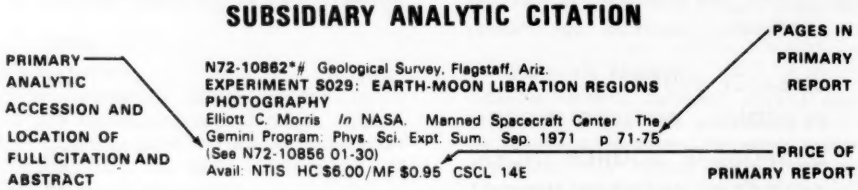
PRIMARY ANALYTIC CITATION AND ABSTRACT



N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp., Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

SUBSIDIARY ANALYTIC CITATION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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 22 / NOVEMBER 23, 1972

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-30989# Aeronautical Research Labs., Melbourne (Australia).
SEGMENTED BLUNT TRAILING EDGES AT SUBSONIC AND TRANSONIC SPEEDS
N. Pollock Feb. 1972 46 p refs
(ARL/A-Rept-137) Avail: NTIS HC $4.50

The flow mechanism responsible for the low drag of blunt edges was determined, and this information was used to design base geometries with even lower drag. On the basis of the flow model, a segmented base was designed which was found to have a lower drag than any previously tested base geometry through the whole of the test Mach number range (0.5 less than or equal to Mo less than or equal to 1.20). Author

N72-30990# National Physical Lab., Teddington (England). Div. of Maritime Science.
THE EFFECT OF A SHROUD ON THE TIME-AVERAGE AERODYNAMIC FORCES ON A TWO-DIMENSIONAL SQUARE-SECTION CYLINDER
C. F. Cowdrey May 1972 21 p
(NPL-Mar-Sci-6-72) Avail: NTIS HC $3.25

Vortex-excited oscillations of a cantilever right-circular cylinder were repressed by perforated shrouds fitted concentrically around, and slightly separated from, the cylinder. A series of dynamic tests were carried out in a wind tunnel to investigate the influence of a shroud on a square-section cantilever. The measurements of the time-average forces on a two-dimensional cylinder of the same section were made. Using these results, some general observations are made of the effect of the shroud on the tendency to wind-induced galloping oscillations. Author

N72-30991*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC AERODYNAMIC CHARACTERISTICS OF A LIFTING-BODY ORBITER MODEL WITH A BLUNTED DELTA PLANFORM AT MACH 2.30 TO 4.60
A. B. Blair, Jr. Washington Sep. 1972 94 p
(NASA-TM-X-2581; L-8366) Avail: NTIS HC $3.00 CSCL 01A

An investigation has been made in the Langley Unitary Plan wind tunnel to determine the aerodynamic characteristics of a lifting-body orbiter model with a blunted delta planform. The model was tested at Mach numbers from 2.30 to 4.60, at nominal angles of attack from -4 deg to 60 deg and angles of sideslip from -4 deg to 10 deg, and at a Reynolds number of 2.5 million per foot. Author

N72-30992*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC EFFECTS OF LEADING-EDGE SERRATIONS ON A TWO-DIMENSIONAL AIRFOIL
Paul T. Soderman Washington Sep. 1972 39 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-2643; A-3706) Avail: NTIS HC $3.00 CSCL 01A

An investigation was conducted to determine the flow field and aerodynamic effects of leading-edge serrations on a two-dimensional airfoil at a Mach number of 0.13. The model was a NACA 66-012 airfoil section with a 0.76 m (30 in.) chord, 1.02 m (40 in.) span, and floor and end plates. It was mounted in the Ames 7- by 10-Foot Wind Tunnel. Serrated brass strips of various sizes and shapes were attached to the model in the region of the leading edge. Force and moment data, and photographs of tuft patterns and of oil flow patterns are presented. Results indicated that the smaller serrations, when properly placed on the airfoil, created vortices that increased maximum lift and angle of attack for maximum lift. The drag of the airfoil was not increased by these serrations at airfoil angles of attack near zero and was decreased at large angles of attack. Important parameters were serration size, position on the airfoil, and spacing between serrations. Author

N72-30993# Technische Univ., Berlin (West Germany).
CONTRIBUTION TO VIBRATION CALCULATIONS ON POINTED ARROW WINGS Ph.D. Thesis [EIN BEITRAG ZUR SCHWINGUNGSRECHNUNG VON ZUGESPITZEN PFEILFUEGELN]
K. Diethart Collmann 1971 86 p refs In GERMAN
Avail: NTIS HC $6.50

Linear elastic theory is used to calculate eigenforms and oscillating frequencies of pointed arrow wings. Considered are only airfoils with parallel reinforcing ribs. The program develops stability matrices, reduces these matrices to the format of oscillation calculations and integration by the same coding procedures and determines eigenvalues and eigenvectors with the Q-R procedure or iterative deflation. Arrow wing coordinates are used to develop the stability matrix expressing rib direction. Transl. by G.G.

N72-30994# National Physical Lab., Teddington (England). Aerodynamics Div.
THE THEORETICAL TREATMENT OF SLOWLY OSCILLATING PART-SPAN CONTROL SURFACES IN SUBSONIC FLOW
H. C. Garner and Doris E. Lehrian London Aeron. Res. Council 1971 101 p refs Supersedes NPL-AERO-1303; ARC-31490;

see N71-11013
(ARC-R/M-3676; NPL-AERO-1303; ARC-31490) Avail: NTIS HC $7.25; HMSO £2.60; PHI $10.20

Chordwise and spanwise equivalent slopes are combined to give smooth equivalent incidences in place of discontinuities at the hinge and part-span boundaries of trailing-edge controls. Wing forces, hinge moments and their spanwise distributions are calculated to first order in frequency for four planforms. Theoretical accuracy is analyzed for ranges of control chord, control span and Mach number. Comparisons with measured hinge moments are made, and a simple empirical correction to damping is suggested. Author (ESRO)

N72-30995# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

TURBULENT BOUNDARY LAYERS ON A LARGE FLAT PLATE AT M EQUALS 4

R. C. Hastings and W. G. Sawyer London Aeron. Res. Council 1971 59 p refs Supersedes RAE-TR-70040; ARC-32427
(ARC-R/M-3678; RAE-TR-70040; ARC-32427) Avail: NTIS HC $5.00; HMSO £2.10; PHI $8.20

Transition positions, local skin-friction coefficients and boundary layer profiles measured in adiabatic flow on a flat plate are given. The data are for turbulent flow and cover a range of momentum-thickness Reynolds numbers of approximately 2500 to 25000. At high Reynolds number, skin-friction coefficients are well predicted by the relations of Spalding and Chi or Winter and Gaudet. Below a Reynolds number of roughly 10000 the results, though less reliable, seem to lie above these predictions; the higher values are corroborated by data from other sources. The inner parts of the velocity profiles follow a common law, and at high Reynolds numbers the velocity-defect profile of the outer layer agrees with a number of previous predictions. The outer parts of the profiles exhibit a wake component which decreases with decreasing Reynolds number and eventually vanishes. In respect of this behaviour, the compressible flow corresponds to an incomparable flow at a much lower Reynolds number.
Author (ESRO)

N72-30996# Royal Aircraft Establishment, Bedford (England). Aerodynamics/Flight Dept.

THEORETICAL ASSESSMENT OF THE GENERAL STABILITY AND GUST RESPONSE CHARACTERISTICS OF STOL AIRCRAFT

W. J. G. Pinsker London Aeron. Res. Council Feb. 1971 83 p refs Supersedes RAE-TR-71028; ARC-32844
(ARC-R/M-3686; RAE-TR-71028; ARC-32844) Avail: NTIS HC $6.25; HMSO £2.92; PHI $11.55

Results are presented of theoretical studies into the likely stability and gust response characteristics of four distinct classes of STOL aircraft, namely those using low wing loading and high C sub L max alone, partly jet-borne configurations, aircraft using jet-flap-type wing-lift augmentation, and designs exploiting propeller slipstream. The areas considered are gust sensitivity, cross-wind control, dynamic response to gusts, speed stability, stability in flight under attitude constraint and dynamic longitudinal and lateral stability with fixed controls. Author (ESRO)

N72-30997# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

THE MEASUREMENT OF GROUND EFFECT USING A FIXED GROUND BOARD IN A WIND TUNNEL

L. F. East London Aeron. Res. Council 1972 57 p refs Supersedes RAE-TR-70123; ARC-32633
(ARC-R/M-3689; RAE-TR-70123; ARC-32633) Avail: NTIS HC $5.00; HMSO £2.10; PHI $8.20

An experimental and theoretical investigation is made of the method of determining the effect of ground proximity in a wind tunnel using a fixed board to represent the ground. The influence which the boundary layer on the fixed ground board has on the flow about the model has been determined from overall force measurements on three models of aspect ratios 1.6, 3 and 8 and the two-dimensional configuration has been solved theoretically. These measurements and calculations show that the boundary layer influence is most significant at the lower aspect ratios and for these configurations an experimental procedure is proposed which enables this influence upon the data to be eliminated. The form of the three-dimensional boundary layer which grows on a fixed ground board beneath a low aspect ratio model is discussed and the reason for its influence upon the explained. A brief discussion of the form of the three-dimensional boundary layer which will grow on a runway as an aircraft passes by is given and the case of infinite aspect ratio (two-dimensional flow) has been analyzed theoretically. Author (ESRO)

N72-30998# Royal Aircraft Establishment, Farnborough (England).

A STUDY OF DYNAMIC AEROELASTIC EFFECTS ON THE STABILITY CONTROL AND GUST RESPONSE OF A SLENDER DELTA AIRCRAFT

E. G. Broadbent, J. K. Zbrozek (Sheffield Univ., Engl.), and E. Huntley London Aeron. Res. Council 1972 57 p refs Supersedes ARC-32779
(ARC-R/M-3690; ARC-32779) Avail: NTIS HC $5.00; HMSO £2.10; PHI $8.20

Four theoretical investigations relating to a specific configuration are combined. Instability of the short period mode, as aircraft stiffness is reduced, is investigated from different points of view and implications with regard to aircraft controllability are worked out. Bending responses of the aircraft to discrete gusts are evaluated using the previously established mathematical model. Author (ESRO)

N72-30999# Aeronautical Research Council, London (England).

CALCULATIONS OF THE FLOW OVER THICK, CONICAL, SLENDER WINGS WITH LEADING-EDGE SEPARATION

J. H. B. Smith 1972 69 p refs Supersedes RAE-TR-71057; ARC-33024
(ARC-R/M-3694; RAE-TR-71057; ARC-33024) Avail: NTIS HC $5.50; HMSO £2.40; PHI $9.40

The vortex-sheet model of leading-edge separation previously applied to flat-plate delta wings has been applied to thick delta wings in the form of rhombic cones. The simplifications introduced by the use of slender-body theory and an asymptotic treatment for the core of the vortex have been retained. The results show that the vortex sheet leaves the wing tangentially to the lower surface. The calculations reproduce the observed trends with increasing thickness: the vortex core moves upwards and outwards and the circulation and both the linear and non-linear parts of the lift fall off. The quantitative agreement between theory and experiment worsens somewhat as the thickness increases, probably indicating an increase in the influence of the secondary separation. Author (ESRO)

N72-31000# Cambridge Univ. (England). Dept. of Engineering.

EXPERIMENTS IN TURBULENT BOUNDARY LAYERS WITH FOREIGN GAS INJECTION

D. I. A. Dunbar and L. C. Squire London Aeron. Res. Council 1972 77 p refs Supersedes ARC-32904
(ARC-R/M-3696; ARC-32904) Avail: NTIS HC $6.00; HMSO £ L2.80; PHI $11.00

Velocity, temperature, and concentration profiles have been measured for a turbulent boundary layer with homogeneous injection of carbon dioxide, at Mach number from 0.5 to 3.6. The results in tabular form and a preliminary analysis of the results are given. Author (ESRO)

N72-31001# British Aircraft Corp., Preston (England). Flight Simulation Section.

A FLIGHT SIMULATOR INVESTIGATION OF THE EFFECT OF TURBULENCE ON ROLLING REQUIREMENTS AT LOW SPEED

A. G. Barnes and N. A. Parsons London Aeron. Res. Council 1972 42 p refs Supersedes ARC-33046
(ARC-R/M-3697; ARC-33046) Avail: NTIS HC $4.25; HMSO

£1.55; PHI $6.25

A moving base simulator investigation of the rolling requirements in turbulence of an aircraft on the landing approach is described. A typical swept fighter type aircraft was simulated and pilot opinions were obtained for differing values of the maximum rolling acceleration for full aileron and for differing levels of turbulence. Known aircraft were also simulated for comparison with the results of the parametric study.

Author (ESRO)

N72-31002# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE EFFECT OF RIDGE EXCRESCENCES AND TRAILING-EDGE CONTROL GAPS ON TWO-DIMENSIONAL AEROFOIL CHARACTERISTICS

T. A. Cook London Aeron. Res. Council 1972 42 p refs Supersedes RAE-TR-71080; ARC-33194

(ARC-R/M-3698; RAE-TR-71080; ARC-33194) Avail: NTIS HC $4.25; HMSO £1.55; PHI $6.25

Wind tunnel measurements of the effects on two-dimensional section characteristics of square ridge excrescences and of some gaps typical of those found around trailing-edge controls have been made at high subsonic Mach number and at Reynolds numbers up to 15.6 million based on section chord length. The incremental drag due to a square ridge was found to be generally underestimated by applying an estimated magnification factor to flat-plate measurements. Trailing-edge control gaps affected lift and pitching moment characteristics of the aerofoil as well as drag. A tentative correlation of the measurements of drag due to spanwise gaps is suggested. Author (ESRO)

N72-31003# Aeronautical Research Council, London (England).

AN INVESTIGATION OF TRANSITION FIXING TECHNIQUE FOR A 10.5% THICK, 28 DEG SWEPTBACK WING AT HIGH SUBSONIC SPEEDS AND R APPROXIMATELY 3 MILLION

P. G. Hutton 1972 58 p refs Supersedes ARC-32220; ARA-16

(ARC-CP-1215; ARC-32220; ARA-16) Avail: NTIS HC $5.00; HMSO 95p; PHI $3.90

Forces and pressures on a wing of modern design with upper surface transition free or fixed by alternative roughness bands are given. Development of separated flow and shock positions were very sensitive to transition conditions. Applicability to full scale is discussed. The care needed in fixing transition with an incipient rear separation (class B flow) and the value of pressure plotting are illustrated. Examples of results are given.

Author (ESRO)

N72-31004# ARO, Inc., Arnold Air Force Station, Tenn.

ANALYSIS OF THE THREE DIMENSIONAL COMPRESSIBLE TURBULENT BOUNDARY LAYER ON A SHARP CONE AT INCIDENCE IN SUPERSONIC AND HYPERSONIC FLOW Final Report, Jul. 1971 - Feb. 1972

John C. Adams, Jr. AEDC Jun. 1972 96 p refs

(Contract F40600-72-C-0003; ARO Proj. VW5206)

(AD-743003; ARO-VKF-TR-72-37; AEDC-TR-72-66) Avail: NTIS CSCL 16/3

An analytical approach toward numerical calculation of the three-dimensional turbulent boundary layer on a sharp cone at incidence under supersonic and hypersonic flow conditions is presented. The theoretical model is based on implicit finite-difference integration of the governing three-dimensional turbulent boundary-layer equations in conjunction with a three-dimensional scalar eddy-viscosity model of turbulence. Comparison is made of present theory with detailed experimental measurements of the three-dimensional turbulent boundary-layer structure (velocity and temperature profiles), the surface streamline direction (obtained via an oil-flow technique) and surface heat-transfer rate. GRA

N72-31005# Naval Postgraduate School, Monterey, Calif.

LAMINAR BOUNDARY LAYER DEVELOPMENT DOWN-STREAM OF A SUCTION SLOT M.S. Thesis

Sabri Cigdem Dec. 1971 117 p refs

(AD-742937) Avail: NTIS CSCL 20/4

Laminar boundary layer development downstream of a suction slot was investigated in a low velocity wind tunnel. In order to observe the effect of suction on the boundary layer, detailed boundary layer profiles were measured at various stations upstream and downstream of a suction slot for different suction flow rates. The investigation was carried out for zero suction, 53.33 SCFH/FT. and 133.33 SCFH/FT. suction, by using 1/16 inch suction slot. The velocity profiles were plotted for 22 stations with different suction flow rates with respect to the no suction flow case. At the far upstream and downstream side of the slot, suction was ineffective and velocity profiles had the Blasius velocity profile shape. Suction had the maximum effectiveness a short distance in front of and downstream of the slot. As the distance from the slot increased both upstream and downstream, the velocity profiles tended to approach Blasius velocity profiles asymptotically. Author (GRA)

N72-31006# Naval Postgraduate School, Monterey, Calif.

THE DERIVATION, SOLUTION, AND ANALYSIS OF AIRPLANE SPIN EQUATIONS MODELED IN AN INERTIAL COORDINATE SYSTEM M.S. Thesis

Roy Robert Buehler Mar. 1972 67 p refs

(AD-742929) Avail: NTIS CSCL 01/2

The general equations of motion for a rigid body are derived in cylindrical coordinates by Lagrangian dynamics and used to model the motion of an airplane in a steady spin. After simplification, the equations are cast into a form utilizing conventional aerodynamic derivatives along with other derivatives which may be significant in spins. An iterative numerical solution procedure is outlined which should simplify the problem of solving the nonlinear differential equations, and relationships between the Euler Angles used in the equations and the more familiar ordered set of pitch, roll, and yaw are derived to permit computer input and output of orientation to be more easily visualized. Author (GRA)

N72-31007# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.

EFFECT OF A LATERAL SUPPORT STRUT ON BODY PRESSURE DISTRIBUTIONS AT TRANSONIC SPEEDS

Donald V. Rubin Jan. 1972 18 p

(DA Proj. 1M2-62303-A-214)

(AD-743178; RD-TR-72-6) Avail: NTIS CSCL 14/2

The effect of a strut support on the measured pressure distributions along a missile at transonic speeds was determined qualitatively by comparing data obtained on strut and sting mounts, using the same model in various configurations. The comparison showed how the presence of a mounting strut influences the pressure distribution along the model body.

Author (GRA)

N72-31008# General Dynamics/Convair, San Diego, Calif. Aerospace Div.

AERONAUTICAL EXPLORATORY RESEARCH ON ADVANCED JET FLAP SUPERCRITICAL AIRFOILS Interim Technical Report, 1 Mar. 1971 - 29 Feb. 1972

Hideo Yoshihara, Wilbert V. Carter, G. Joseph Fatta, Richard J. Magnus, and Robert T. Murray 29 Feb. 1972 60 p refs

(Contract N00014-71-C-0161; NR Proj. 212-203)

(AD-744036) Avail: NTIS CSCL 20/4

The goal of the study is to seek a supercritical profile shape which has improved transonic performance in the presence of the jet flap effect. Based upon existing experience four profiles have been evolved. The present report describes the results for two of these airfoils, one having a Coanda jet flap configuration. In the tests pressure distributions, schlieren observations, and wake surveys were obtained. The results are reported.

Author (GRA)

N72-31009# ARO, Inc., Arnold Air Force Station, Tenn.
A GENERAL METHOD FOR CALCULATING THREE DIMENSIONAL NONSTATIONARY AEROELASTIC RESPONSE IN SUBSONIC FLOWS Final Report
Alva Darrell Devers AEDC May 1972 167 p refs
(Contract F40600-72-C-0003; AF Proj. 1366)
(AD-742996; ARO-OMD-TR-72-32; AEDC-TR-72-59) Avail: NTIS CSCL 01/3

The study presents a generalized method which couples three dimensional, unsteady aerodynamic forces with elastic deformations and surface deflections for an arbitrarily configured vehicle imbedded in a subsonic flow field. Although the basic theories are well known, the composite formulation and technique of solving the resulting equations are new. Vortex lattice methods are extended to include unsteady motions and these methods are combined with current developments in structural dynamics to establish a unique approach for attacking problems involving dynamic aeroelastic phenomena. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-31010# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. ALLEGHENY AIRLINES, INCORPORATED, ALLISON PROP JET CONVAIR 340/440, N5832, NEW HAVEN, CONNECTICUT, 7 JUNE 1971
1 Jun. 1972 72 p refs
(NTSB-AAR-72-20; SA-427) Avail: NTIS HC $5.75

A Convair 340 aircraft crashed during an approach to the New Haven, Connecticut airport on 7 June 1971. Twenty-eight passengers and two crewmembers were fatally injured. Two passengers and the first officer survived. The probable cause of the accident was the captain's intentional descent below the prescribed minimum descent altitude under adverse weather conditions, without adequate forward visibility or sighting of runway environment. Author

N72-31011# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. NATIONAL AIRLINES, INCORPORATED, BOEING 747-135, N77772, NEAR LAKE CHARLES, LOUISIANA, 4 JANUARY 1972
12 Jul. 1972 13 p
(NTSB-AAR-72-21) Avail: NTIS HC $3.00; Natl. Transp. Safety Board, Office of Gen. Manager, Accident Inquiries and Records Sect., Washington, D. C. 20591

An incident involving a Boeing 747 aircraft during flight is reported. The aircraft encountered a gust of sharp convective turbulence at 31,000 feet, resulting in injuries to several passengers and four stewardesses. The flight continued to its destination. The cause of the incident was attributed to the meteorological conditions encountered and the fact that the passengers had not obeyed the sign to fasten their seat belts. Author

N72-31012# RAND Corp., Santa Monica, Calif.
EUROPEAN AND US AIRCRAFT DEVELOPMENT STRATEGIES
Robert Perry Dec. 1971 18 p refs
(P-4748) Avail: NTIS HC $3.00

The procedures used by United States and European aircraft manufactures in the design, development, and production of high performance aircraft are compared. The relationships between research and development for the different systems are examined. The effects of design complications, initial flight tests, lack of redundancy, and procurement practices on the cost of the final product are analyzed. It is concluded that general adoption of a strategy of incremental acquisition and a policy of austere development should result in lower cost growth and lower acquisition costs. Author

N72-31013*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LATERAL STABILITY AND CONTROL DERIVATIVES OF A JET FIGHTER AIRPLANE EXTRACTED FROM FLIGHT TEST DATA BY UTILIZING MAXIMUM LIKELIHOOD ESTIMATION
Russell V. Parrish and George G. Steinmetz Washington Sep. 1972 52 p refs
(NASA-TN-D-6905; L-8378) Avail: NTIS HC $3.00 CSCL 01B

A method of parameter extraction for stability and control derivatives of aircraft from flight test data, implementing maximum likelihood estimation, has been developed and successfully applied to actual lateral flight test data from a modern sophisticated jet fighter. This application demonstrates the important role played by the analyst in combining engineering judgment and estimator statistics to yield meaningful results. During the analysis, the problems of uniqueness of the extracted set of parameters and of longitudinal coupling effects were encountered and resolved. The results for all flight runs are presented in tabular form and as time history comparisons between the estimated states and the actual flight test data. Author

N72-31014*# Air Vehicle Corp., San Diego, Calif.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF CIRCULATION CONTROL BY MEANS OF A TURBULENT COANDA JET
E. S. Levinsky and T. T. Yeh Washington NASA Sep. 1972 98 p refs
(Contract NAS2-5359)
(NASA-CR-2114) Avail: NTIS HC $3.00 CSCL 01A

An analytical and experimental investigation of circulation control on a circular cylinder by means of tangential blowing (Coanda effect) is presented. The analytical method developed has also been used to estimate the blowing coefficients required for achieving potential flow on airfoils with flaps. The analysis is presented for conditions for which the flow in the boundary layer ahead of the jet exit is turbulent. The turbulent boundary layer and the jet layer on the upper surface, and the turbulent boundary layer on the lower surface are computed by a multi-strip integral method. The region of integration is between the correponding transition and separation points on each surface. Longitudinal curvature effects, which give rise to a radial pressure gradient across the jet layer and to an additional adverse tangential pressure gradient just upstream of the separation point, are included in the jet layer analysis in an approximate manner. The longitudinal curvature effect is found to have a pronounced influence on the separation of the jet layer. Author

N72-31015# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
V/STOL COMMUNITY ANNOYANCE DUE TO NOISE PROPOSED INDICES AND LEVELS
G. W. Johnston Mar. 1972 43 p refs
(UTIAS-TN-177) Avail: NTIS HC $4.25

Contrasted with conventional aircraft and airport noise, distinctive features relating to V/STOL systems are noted. Currently popular methods for assessing conventional aircraft noise (CNR and NEF) are shown to be much less appropriate for V/STOL. Both speech interference and perceived noise annoyances have been included in parallel. Perceived noise contours (LNP) calculated adjacent to a hypothetical waterfront STOLport site confirm that when the aircraft noise exceeds the background by

10 db or less, community annoyance grows imperceptibly with the number of similar operations flown. Smaller aircraft operating in larger numbers, to fulfill a given transportation task, therefore offer a substantial annoyance improvement over larger similar technology aircraft. V/STOL noise certification rules permitting a substantial noise increase with size (3 or 4 db per doubling or more) cannot adequately preserve the community amenity. Author

N72-31016# Civil Aeronautics Board, Washington, D.C. Bureau of Operating Rights.
SERVICE TO SMALL COMMUNITIES. PART 1: LOCAL SERVICE CARRIER COSTS AND SUBSIDY NEED REQUIREMENTS TO SERVE MARGINAL ROUTES
Mar. 1972 114 p
Avail: NTIS HC $7.75

Cost analyses of several small airlines in the United States were conducted to determine causes for continuing lack of profitable operation. The services provided by the airlines are described. The economic status for 1969 is examined. The factual data developed, and the conclusions derived are useful in evaluating various alternatives related to continuing or changing the type of service provided to the smaller and relatively isolated communities which are incapable of fully supporting, on a self sustaining basis, certificated air service. Author

N72-31017# Civil Aeronautics Board, Washington, D.C. Bureau of Operating Rights.
SERVICE TO SMALL COMMUNITIES. PART 2: SMALL AIRCRAFT AND SMALL COMMUNITIES: A HISTORY AND ECONOMIC ANALYSIS
Mar. 1972 150 p refs
Avail: NTIS HC $9.50

The development of small community air service from the 1930's to the present, with particular emphasis on the aircraft types employed over the years is discussed. The regulatory process which allowed the local service carriers to eliminate their DC-3 fleets in favor of larger aircraft, as well as the failure to find a suitable DC-3 replacement are explored in detail. The rise of the commuter carrier industry, particularly after the development of higher capacity turboprop aircraft in the mid-sixties, is also set forth. A comparative economic analysis of aircraft types, including those currently in use with both the local service carriers and the principal commuter air carriers is presented. The cost levels, direct and indirect, experienced by commuter carriers with those of the local service carriers are compared. Finally, the study shows that existing local service routes can be offered superior service, on a more economical basis, with small aircraft, operated either by local service or commuter air carriers. Author

N72-31018# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: WESTERN AIR LINES, INCORPORATED BOEING 720-047B, N3166 ONTARIO INTERNATIONAL AIRPORT, ONTARIO, CALIFORNIA, 31 MARCH 1971
7 Jun. 1972 42 p
(NTSB-AAR-72-18) Avail: NTIS HC $4.25

A Boeing 720B, on a proficiency check flight, yawed and rolled out of control, and crashed while in the process of executing a 3-engine missed-approach from a simulated engine-out ILS instrument approach. The five crewmembers and only occupants died in the crash. The weather conditions were 600 feet overcast, with 3/4-mile visibility in fog, haze, and smoke. The probable cause of this accident was the failure of the aircraft rudder hydraulic actuator support fitting. The failure of the fitting resulted in the inapparent loss of left rudder control which, under the conditions of this flight, precluded the pilot's ability to maintain directional control during a simulated engine-out missed-approach. The existing weather conditions degraded external visual cues, thereby hampering rapid assessment of aircraft performance by the flight check captain. Author

N72-31019# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: ALII AIR HAWAII, INCORPORATED, BEECH D18S, N5642V, KALOHI CHANNEL, HAWAIIAN ISLANDS, 22 FEBRUARY 1972
26 Jul. 1972 11 p
(NTSB-AAR-72-23) Avail: NTIS HC $3.00; Natl. Transportation Safety Board, Office of Gen. Manager, Accident Inquiries and Records Sect., Washington, D. C. 20591

A Beech D18S, was a scheduled visual flight rules air taxi passenger and cargo flight operating from Honolulu, Hawaii, to Lanai, Hawaii. The flight departed Honolulu at 0645 H.s.t., and crashed into the Pacific Ocean in the Kalohi Channel area at a point approximately 38 nautical miles southeast of Honolulu Airport. The accident occurred at approximately 0705 H.s.t. The bodies of three of the passengers and the pilot were not recovered. The aircraft was destroyed and sank into the ocean. There were well-developed rain showers and thunderstorms, with associated turbulence, lightning, and hail in the area; however, visual flight could have been maintained by circumnavigation of this activity. The probable cause of this accident was flight into an area of known instrument meteorological conditions containing thunderstorm activity, which culminated in a collision with the water for unknown reasons. Author

N72-31020*# Boeing Co., Seattle, Wash. Commercial Airplane Group.
DESIGN EVALUATION CRITERIA FOR COMMERCIAL STOL TRANSPORTS
R. L. Allison, M. Mack, and P. C. Rumsey Jun. 1972 202 p refs
(Contract NAS2-6344)
(NASA-CR-114454; D6-40409) Avail: NTIS HC $12.25 CSCL 01B

Handling qualities criteria and operational performance margins have been determined for the landing phase of commercial short-takeoff-and-landing airplanes. The requirements are the result of a literature survey, analysis of areas found to be inadequately covered by current criteria, and a subsequent piloted simulator investigation of critical criteria requiring substantiation. Three complete simulator models were used, each describing the characteristics of a different high-lift system, the externally blown flap, the augmentor flap, and the internally blown flap. The proposed criteria are presented with substantiating discussions from currently available data or directly from the results of this simulation work where it is applicable. Author

N72-31021*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SONIC-BOOM MEASUREMENTS FOR SR-71 AIRCRAFT OPERATING AT MACH NUMBERS TO 3.0 AND ALTITUDES TO 24384 METERS
Domenic J. Maglieri, Vera Huckel, and Herbert R. Henderson Washington Sep. 1972 59 p refs
(NASA-TN-D-6823; L-8337) Avail: NTIS HC $3.00 CSCL 01B

Sonic-boom pressure signatures produced by the SR-71 aircraft at altitudes from 10,668 to 24,384 meters and Mach numbers 1.35 to 3.0 were obtained as an adjunct to the sonic boom evaluation program relating to structural and subjective response which was conducted in 1966-1967 time period. Approximately 2000 sonic-boom signatures from 33 flights of the SR-71 vehicle and two flights of the F-12 vehicle were recorded. Measured ground-pressure signatures for both on-track and lateral measuring station locations are presented and the statistical variations of the overpressure, positive impulse, wave duration, and shock-wave rise time are illustrated. Author

N72-31022*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ENGINEERING OPTIMIZATION METHOD WITH APPLICATION TO STOL-AIRCRAFT APPROACH AND LANDING TRAJECTORIES
Heinrich G. Jacob Washington Sep. 1972 43 p refs

(NASA-TN-D-6978; A-4323) Avail: NTIS HC $3.00 CSCL 01B

An optimization method has been developed that computes the optimal open loop inputs for a dynamical system by observing only its output. The method reduces to static optimization by expressing the inputs as series of functions with parameters to be optimized. Since the method is not concerned with the details of the dynamical system to be optimized, it works for both linear and nonlinear systems. The method and the application to optimizing longitudinal landing paths for a STOL aircraft with an augmented wing are discussed. Noise, fuel, time, and path deviation minimizations are considered with and without angle of attack, acceleration excursion, flight path, endpoint, and other constraints. Author

N72-31023# Institut Franco-Allemand de Recherches, St. Louis (France).

INTERACTION OF THE SONIC BOOM AND A WATER SURFACE [INTERACTION DU BANG ET D'UNE NAPPE D'EAU]

A. Peter, C. Thery, J. J. Brunner, and F. Schlosser 26 Oct. 1971 52 p refs In FRENCH

(Contract DRME-71.34.556)

(ISL-31/71) Avail: NTIS HC $4.75

The effect of the sonic boom on shock wave transmission in the ocean was investigated. Using an experimental device which creates a short duration N aerial wave the acoustic signal propagation under the free surface of a water layer was measured. It was shown that only the vicinity (proximity) of the free surface is subjected to the sonic boom effect. The pressure wave signal decreases to 1/10th of its initial value at a depth equivalent to 1/2 the wavelength of the boom. The comparison of the frequency spectrum of this wave with that of the ambient marine noise shows that the transmitted signal could not be distinguished from the ambient noise. ESRO

N72-31024# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

THE EFFECT OF VARIATIONS IN LOCAL GRAVITY AND OF AIRCRAFT SPEED ON THE EFFECTIVE WEIGHT OF AIRCRAFT IN HIGH PERFORMANCE CRUISE

W. J. G. Pinsker London Aeron. Res. Council 1972 16 p refs Supersedes RAE-TR-69274; ARC-32167

(ARC-R/M-3680; RAE-TR-69274; ARC-32167) Avail: NTIS HC $3.00; HMSO 60p; PHI $2.55

Numerical data are given of the changes in effective gravity experienced by aircraft in flight at various heights and speeds. In most flight conditions this results in a reduction in the effective weight experienced by aircraft which is shown to vary considerably with heading and latitude. For Concorde in cruise there is a reduction in effective weight of approximately 0.5% in westbound flight and this increases to more than 2% in eastbound flight. Author (ESRO)

N72-31025# Royal Aircraft Establishment, Bedford (England). Aerodynamics/Flight Dept.

MEASUREMENT OF THE YAWING MOMENT OF INERTIA OF AN AIRCRAFT (HP115) IN FLIGHT

R. L. Poulter London Aeron. Res. Council 1972 22 p refs Supersedes RAE-TR-70223; ARC-32787

(ARC-R/M-3691; RAE-TR-70223; ARC-32787) Avail: NTIS HC $3.25; HMSO 82p; PHI $3.55

The yawing moment of inertia has been obtained by measuring the acceleration in yaw resulting from the release of a wing-tip parachute. Lateral accelerometers mounted near the fore and aft extremities of the aircraft on a line parallel to the principal axis of inertia were used to measure the yawing acceleration. The principal axis is known in this case from previous ground measurements, but it is shown that 1 deg error in axis inclination would only produce an error of about 3% in the measured inertia. The results obtained from the flight tests are encouraging and are about 3 1/2% lower than earlier measurements on a ground rig and about 2 1/2% greater than the manufacturer's original estimate. Operational problems are discussed and some improvements to the parachute equipment are also suggested. Author (ESRO)

N72-31026# Minnesota Univ., Minneapolis.

OPENING DYNAMIC CHARACTERISTICS OF A 32 FT RINGSLOT PARACHUTE, STIFFNESS INDEX 0.24, AND 45.2 INCH MODEL, STIFFNESS INDEX 0.40 Final Report, 16 Dec. 1967 - 30 Dec. 1971

H. G. Heinrich and T. R. Hektner Wright-Patterson AFB, Ohio AFFDL May 1972 43 p refs

(Contract F33615-68-C-1227; AF Proj. 6065)

(AD-743099; AFFDL-TR-72-18) Avail: NTIS CSCL 01/3

The stiffness characteristics of full size and model parachutes can be expressed as stiffness indices. A very flexible model was developed with 0.4 stiffness index while a geometrically similar 32-ft ringslot parachute had an index of 0.24. The design details of the flexible model are described. The projected area-time history during the inflation of the 32-ft ringslot parachute, obtained from full size parachute tests, was compared with those of the model ringslot parachute with a stiffness index of 0.40. The area-time characteristics of the model were obtained in wind tunnel tests. GRA

N72-31027# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept. (SI)

EVALUATION OF ADVANCED METHOD FOR STEAM CATAPULT PERFORMANCE PREDICTION WITH SHIP-BOARD TEST DATA Final Report

G. Gaeman, J. Levenson, and W. Goon Apr. 1972 106 p refs

(AD-742804; NAEC-ENG-7741) Avail: NTIS CSCL 01/5

An advanced method which is phenomena-based has been developed in an endeavor to predict steam catapult performance with minimized test correlation effort. This report presents the evaluation of this method by use of present day available shipboard test data. Special techniques are developed to handle these data. The capability of the method is substantiated herein and means to achieve its full potential are also included. Author (GRA)

N72-31028# Army Natick Labs., Mass. Clothing and Personal Life Support Equipment Lab.

ENGINEERING EVALUATION OF AGE LIFE EXTENSION, T-10 HARNESSES, RISERS AND T-10 TROOP CHEST RESERVE PARACHUTE CANOPIES

Roman Maire and Richard D. Wells Mar. 1972 67 p

(AD-742668; C/PLSEL-TS-183; USA-NLABS-TR-72-59-CE) Avail: NTIS CSCL 11/5

A textile and engineering evaluation was conducted by the U.S. Army Natick Laboratories on T-10 troop type Parachute harnesses, risers and chest reserve parachute canopies, obtained from world wide samplings of 6 to 10 year age classes. Despite strength losses in the nylon webbing harness and riser and nylon canopy materials, sufficient residual strength remains in the various components to justify extension of service life above the 10-year limitation now empirically imposed on the items. An additional period of 3 years of age life appears to be justified for harnesses and risers and an additional age life of 2 years for the T-10 reserve parachute canopy. Author (GRA)

N72-31029# RAND Corp., Santa Monica, Calif.

A SIMPLE ADAPTIVE SCHEDULING MECHANISM FOR PLANNING BASE LEVEL INSPECTIONS

Louis Miller Feb. 1972 48 p refs

(Contract F44620-67-C-0045; Proj. RAND)

(AD-743284; R-938-PR) Avail: NTIS CSCL 01/3

The report describes a simple and promising improvement over the two systems now used for scheduling aircraft into base-level inspections. Both the periodic concept (hours flown between inspections are held constant) and the isochronal concept (calendar time held constant) have undesirable traits because aircraft accrue flying hours irregularly over time. The

solution presented here comprises two steps: over a long period (perhaps a fiscal quarter), fix the dates on which inspections will begin (perhaps weekly); divide the period into smaller intervals (perhaps two weeks) and before each interval, schedule those aircraft that have flown the most since their last inspections. Step 1 smooths the flow of work into the docks. Step 2 controls the variability of flying hours between inspections. Author (GRA)

N72-31030# Dynamic Science Engineering Operations, Phoenix, Ariz.
THE DESIGN, FABRICATION, AND TESTING OF AN INTEGRALLY ARMORED CRASHWORTHY CREW SEAT Final Report
Stanley P. Desjardins and Harold D. Harrison Jan. 1972 319 p refs
(Contract DAAJ02-69-C-0030)
(AD-742733; USAAMRDL-TR-71-54; Rept-1680-71-24) Avail: NTIS CSCL 01/3

A program was conducted to develop design technology for integrally armored crashworthy crew seats. The effort included theoretical analysis, design, fabrication, and testing. Dynamic analysis of an occupant seated in an integrally armored crew seat was conducted. Then a seat concept trade-off was performed, a concept was selected and designed, and prototype seats were fabricated. The seats were subjected to a combined static loading test including simultaneous longitudinal, lateral, and vertical components while mounted in a test fixture simulating warped floor conditions typical of crashing aircraft. The seats were then subjected to a series of 10 dynamic tests.
Author (GRA)

N72-31031# Mechanical Technology, Inc., Latham, N.Y.
INVESTIGATION OF GEARBOX DESIGN MODIFICATIONS FOR REDUCING HELICOPTER GEARBOX NOISE Final Technical Report
Robert H. Badgley and Thomas Chiang Mar. 1972 173 p refs
(Contract DAAJ02-70-C-0035; DA Proj. 1G1-62207-AA-72)
(AD-742735; MTI-71TR50; USAAMRDL-TR-72-6) Avail: NTIS CSCL 20/1

Results presented were obtained in a continuing effort to control, through development of vibration and acoustics technology, noise produced by helicopter geared power trains. The results achieved, while not all inclusive, represent a significant step in understanding the generation of gearbox noise. Efforts undertaken, directed at both the UH-1D main and CH-47 forward rotor-drive gearboxes, included predictions of lateral natural frequency and forced response vibration characteristics of the spiral bevel gear shafts, thin-shell predictions of natural frequency and forced-response vibration characteristics of the planetary ring gear casing, general and analytical modeling of gearbox mounts and adjoining airframe structure, and collection and evaluation of existing helicopter internal noise and vibration data from helicopter manufacturers and users. Author (GRA)

N72-31032# Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.
STATE HELIPORT SYSTEM, FEASIBILITY STUDY
Jan. 1972 24 p
(SA-173-1971)
(PB-208395) Avail: NTIS HC $3.00 CSCL 01E

The report takes a statewide look at existing heliports and forecasts additional heliports needed to support short haul and commuter requirements. It also considers the feasibility of establishing an emergency heliport system. Consideration is given to population density and area requirements for V/STOL operations. In conclusion, the report states that there is an immediate demand for coordination with local governments for compatibility and application. Author (GRA)

N72-31033# United Aircraft Corp., East Hartford, Conn.
EXPERIMENTAL INVESTIGATION OF EFFECTS OF BLADE SECTION CAMBER AND PLANFORM TAPER ON ROTOR HOVER PERFORMANCE Final Report, Oct. 1970 - Oct. 1971
E. Dean Bellinger Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Mar. 1972 82 p refs
(Contract DAAJ02-71-C-0012; DA Proj. 1F1-62204-AA-42)
(AD-743232; UARL-K911076-14; USAAMRDL-TR-72-4) Avail: NTIS CSCL 01/3

An experimental and analytical investigation was conducted to determine the effects of blade section camber and blade planform taper on helicopter rotor hover performance and to assess the accuracy of several theoretical methods in predicting such performance. The tests were conducted using small scale model rotors (nominally 4 feet in diameter) operating in and out of ground effect at full-scale tip speeds. The NACA 23112 airfoil, which is a section specifically designed to produce very low pitching moments such as required for helicopter blade applications, was selected for the cambered blade. A nominal taper ratio of 2:1 was selected for the tapered blade tests.
Author (GRA)

N72-31034# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPUTER ANALYSIS OF WINDSHIELD MULTIPLE IMAGING M.S. Thesis
Ralph H. Reed Jun. 1972 69 p refs
(AD-744044; GEP/PH/72-18) Avail: NTIS CSCL 01/3

A study was conducted to develop a computer technique to analyse aircraft windshields for multiple imaging. Two types of multiple imaging were considered: internal reflection, or flare, and secondary reflection. Emphasis was placed on secondary reflection multiple imaging. A CDC 6600 computer and FORTRAN were used throughout the study. A program was developed to evaluate multiple imaging in any windshield configuration reducible to a set of defining mathematical equations. The program is based on a set of general subroutines which allow the performance of related computations, such as pilot field of view or reflection/refraction analysis. Since the visual properties of the windshield may be dependent on pilot position as well as windshield configuration, means are provided to easily change the pilot position. A sample analysis of the effect of pilot position on multiple imaging is given. Author (GRA)

N72-31035# Naval Postgraduate School, Monterey, Calif.
A LITERATURE SURVEY OF THE PROBLEM OF AIRCRAFT SPINS M.S. Thesis
Arne Edward Johnson Sep. 1971 105 p refs
(AD-734976) Avail: NTIS CSCL 01/2

The prediction of aircraft spin characteristics has defied complete scientific analysis. There are, however, a number of research techniques which have been utilized in attempts to understand the mechanism of spin. A survey of the literature dealing with spin research and its application to a wide variety of aircraft designs over the period 1916 to 1971 is presented.
Author (GRA)

N72-31036# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT FROM 1 JANUARY 1962 TO 1 JANUARY 1972 Semiannual Summary Report
Thomas A. DeFiore 1 May 1972 19 p
(AD-743067; NADC-13920-2) Avail: NTIS CSCL 14/2

The report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. Author (GRA)

N72-31037# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
TEST PLAN FOR A STRUCTURAL INTEGRITY INVESTIGATION FOR THE CH-46 AFT TRANSMISSION PLANETARY

CARRIER BEARING NUT IN SUPPORT OF THE ANALYTICAL REWORK PROGRAM Final Report
Ronald P. Swartz 29 Mar. 1972 12 p refs
(AD-743073; NADC-72049-VT) Avail: NTIS CSCL 13/5

The CH-46D mishaps in 1967 and 1971 precipitated a contractor designed fix of the aft transmission planetary carrier bearing nut. This test plan proposes tests to determine if a mode of failure other than that assumed by the contractor could be present. Static and fatigue tests are proposed on both the original and modified versions. Author (GRA)

N72-31038# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. MONMOUTH AIRLINES, INCORPORATED, SCHEDULED AIR TAXI, BEECH 99, N-986MA, ALLENTOWN-BETHLEHEM-EASTON AIRPORT, ALLENTOWN, PENNSYLVANIA, 24 OCTOBER 1971
29 Dec. 1971 17 p
(PB-208198; NTSB-AAR-72-3) Avail: NTIS HC $3.00 CSCL 01B

At approximately 2314 e.d.t., October 24, 1971, a Beech Model 99, crashed at approximately the 1,540-foot level of Blue Mountain during an instrument approach to the Allentown-Bethlehem-Easton Airport, Allentown, Pennsylvania. The captain, copilot, and two passengers were fatally injured. The four remaining passengers were seriously injured. The aircraft caught fire shortly after impact. The cockpit and cabin area were destroyed. However, the surviving passengers were able to evacuate from the aircraft before fire reached the cabin area. The probable cause of this accident was the pilot's nonadherence to approved approach procedures for executing a nonprecision instrument approach in instrument flight conditions.
Author (GRA)

N72-31039# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. DOWNEAST AIRLINES, SCHEDULED AIR TAXI, PIPER PA-31, N595DE, AUGUSTA STATE AIRPORT, AUGUSTA, MAINE, 19 AUGUST 1971
29 Dec. 1971 20 p
(PB-208484; NTSB-AAR-72-6) Avail: NTIS HC $3.00 CSCL 01B

At approximately 2140 e.d.t. on August 19, 1971, Downeast Airlines Flight 88, a scheduled air taxi flight, utilizing a Piper PA-31, N595DE, crashed about 4 miles short of Augusta State Airport while attempting an approach to Runway 17. The approach was being made in instrument conditions. Augusta State Airport is served by a VOR with DME capabilities requiring a nonprecision VOR approach. The weather conditions were above minimums but required an instrument approach. The pilot and two passengers were fatally injured, two passengers received serious injuries and three passengers received minor injuries. The National Transportation Safety Board determined that the probable cause of this accident was the improper action of the pilot in discontinuing the execution of a nonprecision instrument approach and attempting to maintain visual flight while operating in instrument flight conditions at an altitude below the level of obstructing terrain. Author (GRA)

N72-31040# New York Univ., N.Y.
BOUNDARY LAYER CHARACTERISTICS FOR HYPERSONIC FLOW Final Report
Antonio Ferri and Victor Zakkay Jan. 1972 130 p refs
(Contract F33615-68-C-1184)
(AD-744057; ARL-72-0021) Avail: NTIS CSCL 01/3

The main research effort has been concerned in trying to obtain a better understanding as well as to give some insight of the turbulent boundary layer characteristics such that exist on future hypersonic vehicles. The major portion of the experimental effort has been performed at the New York University high Reynolds number Mach 6 facility. In order to understand in detail the boundary layer characteristics, detailed flow field mapping has been performed in several of the research efforts. Several problems requiring semiviscous inviscid interaction problems have been solved by utilizing the vorticity techniques. In addition, research has been performed in a spectrum of related fields. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-31041# Aeronautical Research Labs., Melbourne (Australia).
MOLTEN SALT FUEL CELLS: THE SURFACE STRUCTURE OF MOLTEN ALKALI CARBONATE SYSTEMS
L. W. Hillen Dec. 1971 26 p refs
(ARL/ME-Note-331) Avail: NTIS HC $3.50

For molten carbonate fuel cells, the surface structure of the electrolyte is directly related to one of the most difficult problems in the construction of practical cells, namely the prevention of electrolyte creep over the rest of the cell due to surface tension forces. For ternary mixtures of lithium, sodium and potassium carbonates, such as are currently used as electrolytes, it is shown that the surface activity of ionic compounds in these melts is dependent on the ratio of ionic charge to ionic size. Since the charge to size ratios of the three ions Li(±) Na(±) and K(±) differ, the distribution of these ions in the surface as compared to the bulk material are determined. Attempts to calculate the surface structure of ternary mixtures of alkali carbonates were recently made. Author

N72-31042*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRIC-STEPPING-MOTOR TESTS FOR A CONTROL-DRUM ACTUATOR OF A NUCLEAR REACTOR
Arthur W. Kieffer Washington Sep. 1972 18 p refs
(NASA-TM-X-2639; E-6994) Avail: NTIS HC $3.00 CSCL 09E

Experimental tests were conducted on two stepping motors for application as reactor control-drum actuators. Various control-drum loads with frictional resistances ranging from approximately zero to 40 N-m and inertias ranging from zero to 0.424 kg-sq m were tested. Author

N72-31043# European Space Research Organization, Paris (France).
SPACECRAFT POWER CONDITIONING ELECTRONICS
Jul. 1972 321 p refs Partly in ENGLISH and partly in FRENCH Proc. of a seminar held at ESTEC, Noordwijk, Neth., Apr. 1972
(ESRO-SP-84) Avail: NTIS HC $18.25

Experience in design, testing, and manufacturing accumulated by European industry in the spacecraft power supplies field is described. The papers are in four sections covering subsystem design and performance unit design, auxiliary circuits and functions, and problems related to power systems. For individual titles, see N72-31044 through N72-31077.

N72-31044 Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).
SOME SYSTEM ASPECTS OF THE AEROS POWER SUPPLY
W. Alsbach *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 3-10 (For availability see N72-31043 22-03)

A description of the Aeros satellite mission, the overall satellite design and the power system is given. The general development of the power supply system is then traced by comparing the original specification with the actual status of the prototype satellite. ESRO

N72-31045 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

THE POWER SYSTEM OF THE AEROS SATELLITE

W. Mueller *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 11-19 Sponsored partly by Bundesmin. fuer Bildung und Wiss. and partly by Ges. fuer Weltraumforsch. (For availability see N72-31043 22-03)

A description is given of the function and performance of the Aeros satellite power system. Among the aspects discussed are the solar cell array, storage system consisting of NiCd and AgZn batteries, power control conditioning, maximum power point tracker (MPPT) and magnetic and electromagnetic behavior. ESRO

N72-31046 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

DYNAMIC BEHAVIOUR OF POWER CONDITIONING SYSTEMS FOR SATELLITES WITH A MAXIMUM-POWER-POINT-TRACKING SYSTEM

A. Boehringer and J. Haussmann *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 21-28 (For availability see N72-31043 22-03)

The design and elements of a power supply system designed to satisfy the increasing power requirements and high loads of spacecraft are described. To achieve optimum utilisation of the electrical energy generated in satellites, d.c. converters with variable transformation ratio are connected behind the solar generators. By applying an automatic search or adaptation process, the converters can be controlled electronically in such a way that the maximum possible (or admissible) power is fed to the two consuming systems, loads and batteries. Such a MPPT (Maximum-power-point-tracking) system is used in the Aeros satellite. ESRO

N72-31047 Centre National d'Etudes Spatiales, Toulouse (France).

POWER CONDITIONING OF THE FRENCH FR-1, D-2A, AND STRET-1 SATELLITES [CONDITIONNEMENT DE PUISSANCE DES SATELLITES FRANCAIS FR-1, D-2A ET SRET-1]

R. Prido *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 29-50 In FRENCH (For availability see N72-31043 22-03)

The power supply systems of the FR-1, D-2A and SRET-1 satellites are described with particular emphasis on the power conditioning system which consists of non-regulated buses using limited shunts. The various units of the system such as converters and regulators as well as its characteristics are also considered. ESRO

N72-31048 Marconi Space and Defence Systems, Ltd., Portsmouth (England).

REVIEW OF POWER SYSTEMS FOR UK SATELLITES

M. J. Marsh and C. Miere *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 51-58 (For availability see N72-31043 22-03)

Power supply systems in various British satellites are reviewed by noting the development of the different elements and subsystems. The satellites covered are the UK 3, UK 4, UK 5, X3, X4 and Skynet 2. The manufacturing method based on cordwood packaging techniques is also described. ESRO

N72-31049 Van der Heem Electronics N. V., Rijswijk (Netherlands).

THE POWER SYSTEM OF THE ASTRONOMICAL NETHERLANDS SATELLITE

K. C. Bredius *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 59-64 (For availability see N72-31043 22-03)

A functional description of the power units of the Astronomical Netherlands Satellite is given. The power is delivered by two fixed solar panels. The 80 W output is conditioned at levels of 20 V and 5 V by means of a shunt-type regulator and a 20 V to 5 V dc/dc converter. The battery is a package of eighteen 6-Ah Ni-Cd cells and the power is distributed by 24 relay switches, each having an over-current protection. Redundancy switching is initiated either by telecommand or by the power control logic. The mechanical design is based on the principles applied to the ELDO project. Author (ESRO)

N72-31050 Etudes Techniques et Constructions Aerospatiales, Charleroi (Belgium).

THE POWER REGULATOR OF HELIOS SPACECRAFT DESIGN AND DESCRIPTION

J.-P. Roffler *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 65-73 (For availability see N72-31043 22-03)

The design of the main regulator of the Helios spacecraft is explained. After a short description of general and particular constraints, the choice of the regulator is determined and a PWM buck regulator is adopted. The problem of reliability and some particular cases of dangerous failures are then examined. The basic block diagram is established and progressively completed by different specific protection and auxiliary circuits. Particular technological problems such as EMI protection, choice of parts, etc. are briefly described. As a conclusion, the physical and electrical performances of this 280 W buck regulator are listed and analysed. Author (ESRO)

N72-31051 Etudes Techniques et Constructions Aerospatiales, Charleroi (Belgium).

ADVANCED POWER CONDITIONING USING A MAXIMUM POWER POINT TRACKING SYSTEM

A. Poncin *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 75-86 (For availability see N72-31043 22-03)

The advanced power conditioning subsystem developed by ETCA is described together with its advantages and applications. It is considered that a MPPT (maximum power point tracking) system is an optimum solution and a description of the configuration and performance of the regulators and circuits of the MPPT system are given. ESRO

N72-31052 European Space Research and Technology Center, Noordwijk (Netherlands).

A SEQUENCED PWM CONTROLLED POWER CONDITIONING UNIT FOR A REGULATED BUS SATELLITE POWER SYSTEM

A. Capel and D. M. OSullivan *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 87-102 refs (For availability see N72-31043 22-03)

A spacecraft power supply system based on the utilization of PWM units for battery charge and discharge and shunt control regulator functions is described. The mode of operation of the individual units is outlined and the advantages obtained by combining these units in modular power systems stressed. Predicted static and dynamic test performances are also presented. ESRO

N72-31053 AEG-Telefunken, Hamburg (West Germany).

STABILITY CONSIDERATIONS FOR THE SHUNT REGULATION LOOP OF THE SYMPHONIE POWER SUPPLY

Adolf Schreger *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 103-107 (For availability see N72-31043 22-03)

In order to achieve stability of the power supplies in the Symphonie satellite a configuration of a regulated main bus voltage by means of a total shunt was chosen. The specifications, parameters and performance of the system are described. ESRO

N72-31054 AEG-Telefunken, Hamburg (West Germany).

PARALLEL OPERATION OF SOLAR GENERATOR WITH SHUNT REGULATOR AND BATTERY DISCHARGE REGULATOR ON A CONSTANT VOLTAGE MAIN BUS

Eckhard Kienscherf *In* ESRO Spacecraft Power Conditioning

Electron. Jul. 1972 p 109-112 (For availability see N72-31043 22-03)

A method is described to minimize the unused current in the shunt during parallel operation of a solar generator with shunt regulator and battery-discharge regulator. The system, used in the Symphonie satellite, amplifies the voltage proportional to the shunt current to a proper value, reduces the reference voltage for the discharge regulator and delays the reference signal for stability reasons. ESRO

N72-31055 European Space Research and Technology Center, Noordwijk (Netherlands).

DIGITAL SHUNT POWER CONDITIONING SYSTEM FOR SATELLITES USING LARGE POWER SUPPLIES [SYSTEME DE CONDITIONNEMENT DE PUISSANCE A SHUNT DIGITAL POUR SATELLITES DE FORTE PUISSANCE]

F. Forattini *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 113-115 In FRENCH (For availability see N72-31043 22-03)

A study has been made to find an optimal configuration for a power conditioning system permitting energy transfer from a solar array to a modular battery. Two configurations are described with regulated and nonregulated bar. ESRO

N72-31056 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

MODULARIZED POWER SYSTEM CONCEPT FOR GENERAL APPLICATION IN SATELLITES AT POWER RANGES UP TO 5 kW

H. Froehlich and W. Mueller *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 117-129 refs (For availability see N72-31043 22-03)

A modular concept with clearly defined subcomponents is proposed for the majority of those components used in power supply systems in order to reduce development costs. The modularization was achieved by using 500-W power units bearing in mind the technological state of the necessary power switches. The main bus voltage was limited to 50 V by the state-of-the-art in semiconductors. ESRO

N72-31057 AEG-Telefunken, Hamburg (West Germany).

STANDARDIZED DESIGN AND TECHNOLOGY OF BLACK BOXES FOR POWER CONDITIONING ELECTRONICS c09

W. Koenneke *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 131-134 (For availability see N72-31043 22-03)

The design and manufacture of housings for power supply electronic equipment as used in the Symphonie satellite are described. The development results show the flexibility and low costs as regards fabrication and storage. ESRO

N72-31058 European Space Research and Technology Center, Noordwijk (Netherlands).

THE MULTIPHASE PWM SHUNT

D. M. OSullivan *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 135-143 refs (For availability see N72-31043 22-03)

A new concept of shunt regulator with high effective operation frequency, fast transient response, low output impedance and low bus capacitance requirements utilizing a multiphase PWM drive to the dump is described. ESRO

N72-31059 European Space Research and Technology Center, Noordwijk (Netherlands).

NEW CONTROL TECHNIQUE IN dc/dc REGULATORS FOR SPACE APPLICATIONS

A. Capel *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 145-158 refs (For availability see N72-31043 22-03)

The different functions of a dc/dc regulator are analyzed and the equations of the principle examined emphasizing the separation of the sampling frequency and pulse model parameters. It is shown how these parameters influence the determination of limitation characteristics and short-circuit output currents. The performance of the regulator is considered and the advantages accruing from using a high sampling frequency technique combined with a control loop are outlined. ESRO

N72-31060 Fabrica Italiana Apparecchi Radio S.p.A., Milan (Italy).

Dc/dc REGULATING CONVERTER FOR THE ESRO-4 POWER SYSTEM

F. Ruffo *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 159-163 (For availability see N72-31043 22-03)

In the ESRO-4 satellite the regulated buses are supplied with two identical converters, one operating and one stand-by. Since each converter can be considered as a conventional type, no particular explanation is given about general characteristics and operation. Items which are considered special design requirements or design goals and are solved by means of unconventional solutions are presented in detail to enable the nature of the requirement and the type of adopted solution to be understood. Essential mechanical and electrical characteristics are given as well as details of three particular circuits. Author (ESRO)

N72-31061 Fabrica Italiana Apparecchi Radio S.p.A., Milan (Italy).

POWER GENERATING SYSTEM FOR TRAVELING WAVE TUBES [DISPOSITIF D'ALIMENTATION POUR TOP] c09

L. Giardino *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 165-171 In FRENCH (For availability see N72-31043 22-03)

The principal characteristics of high voltage generators for traveling wave tubes are presented. A block diagram is shown and the best technology for the circuit proposed is chosen. ESRO

N72-31062 Selenia S.p.A., Rome (Italy). Div. Attivita Spaziali.

CIRCUITS FOR DELAYED SWITCHING AND LIMITATION OF TRANSIENTS IN THE POWER TRANSISTORS [CIRCUITS POUR LA COMMUTATION DIFFEREE ET LA LIMITATION DES TRANSITOIRES DANS LES ONDULEURS DE PUISSANCE] c09

S. Roccucci and G. Meneghini *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 173-181 In FRENCH (For availability see N72-31043 22-03)

Two power conditioning units (PCU) have been developed for the Sirio and ESRO telecommunication satellite traveling wave amplifiers. Data relating to both programs and characteristics of power generators as well as tubes are presented. Switching circuits and limiter circuits for transistors are described. ESRO

N72-31063 Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et de ses Applications Spatiales.

ESTABLISHMENT OF A MODEL FOR SMALL SIGNAL BEHAVIOR OF CUTOUT POWER REGULATORS [ETABLISSEMENT D'UN MODELE POUR LE COMPORTEMENT A PETITS SIGNAUX DE CERTAINS REGULATEURS A DECOUPAGE] c09

R. Prajoux *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 183-189 refs In FRENCH (For availability see N72-31043 22-03)

The local behavior model for a multiphase rectifier was extended to the study of small signal behavior of cutout power regulators. This model which consists of an instantaneous sampling system with parameters accessible to experiment, is described and applied to the study of linear data sampling systems. ESRO

N72-31064 Fabrica Italiana Apparecchi Radio S.p.A., Milan (Italy).

MAJOR TOPICS ON dc/ac INVERTER DESIGN

G. Portinari *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 191-197 (For availability see N72-31043 22-03)

Aspects in the design of dc/ac inverters are discussed such as output waveform, filtering aspects and constraints, losses and feedback loops. Methods to judge the feasibility of inverters are also presented. ESRO

N72-31065 Societe Crouzet, Valence (France).
PROTECTIVE SYSTEM FOR THE D-2 SATELLITE BATTERY AND LOW VOLTAGE TRANSFORMERS [SYSTEME DE PROTECTION DE LA BATTERIE ET CONVERTISSEURS BASSES TENSIONS DU SATELLITE D-2]
F. Theveny and H. Col *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 199-206 In FRENCH (For availability see N72-31043 22-03)

Over-voltage and under-voltage detectors used as battery protective systems for the D-2 satellite are described as well as the auxiliary power source used in case of low voltage regulator failure. In addition, principles and electrical characteristics of the five low voltage regulators suitable for the D-2 solar, antisolar, REA, polarization, Lyman alpha experiments are presented. ESRO

N72-31066 AEG-Telefunken, Hamburg (West Germany).
TESTS ON 3.5 Ah NiCd BATTERY CELLS ON SIMULATED 24 H-ORBIT CYCLES AND CONSEQUENCES ON THE CHARGE REGULATOR (GEOSTATIONARY MISSION)
D. Harden *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 207-212 (For availability see N72-31043 22-03)

The effect of C/20 and C/10 charge rates on the capacity evolution of 3.5 Ah NiCd battery cells during periods of eclipse of the Symphonie mission are investigated. The consequences on the charge regulator and the criteria for its design are outlined. ESRO

N72-31067 European Space Research and Technology Center, Noordwijk (Netherlands).
LOW POWER ELECTRONIC AMPERE-HOURS METER FOR SPACE APPLICATION
C. Diolaiti *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 213-221 (For availability see N72-31043 22-03)

Design considerations and detailed circuit descriptions are presented for an electronic ampere-hours meter to be employed in space applications. The instrument continuously monitors the quantity of charged and discharged capacity of a given battery. Cycle data information is transmitted to ground stations in digital form via telemetry channels. Of special significance in this design is the absence of interference with battery operations and the flexibility of its use; in fact, minor modifications enable the instrument to be adapted to a large variety of requirements. However, only the basic design, which acts as a monitoring device, is developed and described. Author (ESRO)

N72-31068 European Space Research and Technology Center, Noordwijk (Netherlands).
VARIATIONS OF ELECTRICAL INPUT PARAMETERS IN A SINGLE BATTERY UNREGULATED BUS CONCEPT
O. H. Gruber *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 223-237 refs (For availability see N72-31043 22-03)

A theoretical survey is provided of a non-regulated bus concept on the ESRO-4 satellite. It features two operational modes with increased power bus impedance during battery-trickle charge and when performing on the output of the solar cell generator alone. The solar cell generator, a body mounted cylindrical array, is considered subject to periodical shadowing by radial booms on the structure of the spinning satellite. A set of interfaces of the power bus characteristic and critical power demands was selected to disclose the possible excursions of the bus voltage during battery-trickle charge. These excursions may establish between about + or - 10% around the maximum-power-point voltage of the array and will occur at multiples of the spin rate. Amplitude and shape are a function of the degree of shadowing, the battery voltage and the relationship between power demand and available power from the array. For operation of the satellite on the solar array alone, design conditions of the unregulated bus circuit were ascertained. The principle of command storage was considered in order to enable automatic restart into an allocated payload program when the satellite is emerging from eclipses. Author (ESRO)

N72-31069 European Space Research and Technology Center, Noordwijk (Netherlands).
MEASUREMENT OF THE UNREGULATED BUS PERFORMANCE OF THE ESRO-4 SATELLITE DURING PERIODICAL ARRAY SHADOWING
H. Lechte *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 239-247 (For availability see N72-31043 22-03)

In the unregulated bus concept of ESRO-4 the modulation caused by periodic boom shadowing on the body mounted solar array, which temporarily reduces the generated current to 70% of its maximum value, leads to a variation of the working point on the 1/V curve of the solar array. When the maximum capability of the array is temporarily exceeded, the bus voltage periodically switches between the battery discharge and trickle charge voltage. The solar array power modulation characteristics are discussed as well as the periodical switching. A set-up for dynamic shadow tests is also described. ESRO

N72-31070 European Space Research and Technology Center, Noordwijk (Netherlands).
NEW METHOD FOR CONTROLLING SATELLITE BATTERIES USING AN AMPERE-HOUR METER [NOUVELLE METHODE DE CONTROLE DES BATTERIES A BORD DES SATELLITES A L'AIDE D'UN AMPERE-HEUREMETRE ELECTRONIQUE]
C. Diolaiti and D. Goudot *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 249-253 In FRENCH (For availability see N72-31043 22-03)

An ampere-hour meter is described which increases the durability of a satellite battery by controlling and defining the change limits, avoiding the over-voltages which provoke thermal and mechanical constraints and therefore reduce the life of the battery. ESRO

N72-31071 Christian Rovsing Ltd., Copenhagen (Denmark).
OPTIMIZATION OF POWER SYSTEMS IN SATELLITES
Jens Bernsen *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 255-260 (For availability see N72-31043 22-03)

An approach to the optimization of power systems in satellites at ESTEC is outlined, with regard to the design criteria, and technical and mathematical assumptions. The structure of the computer programs is described and practical applications noted. ESRO

N72-31072 Compteurs Schlumberger, Montrouge (France).
OPTIMIZATION OF PWM POWER UNITS [OPTIMISATION DES UNITES DE PUISSANCE A DECOUPAGE]
B. Potin *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 261-274 In FRENCH (For availability see N72-31043 22-03)

The units to be optimized are the buck PWM, boost PWM, buck-boost PWM regulators and dc/dc PWM converters. The criterion selected was the satellite weight, and a mathematical model was established which includes the state variables. The parameters to be optimized were deduced and the optimization method is described. ESRO

N72-31073 European Space Research and Technology Center, Noordwijk (Netherlands).
SYSTEM ERROR ANALYSIS
D. M. OSullivan *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 275-283 (For availability see

N72-31043 22-03)

The development of a tool with which complex systems can be analyzed, in order to predict with reasonable accuracy their performance, is described. The tool makes use of the derivation of transfer functions and is simplified by the derivation of a sensitivity formula using a voltage regulator as an example.

ESRO

N72-31074 Centre National de la Recherche Scientifique, Toulouse (France).

DIGITAL SIMULATION OF THE ELECTRICAL BEHAVIOR OF PWM REGULATOR POWER STAGE [SIMULATION NUMERIQUE DU COMPORTEMENT ELECTRIQUE DE L'ETAGE DE PUISSANCE D'UN REGULATEUR A DECOUPAGE]

J.-C. Marpinard, H. Cammas, and R. Prajoux *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 285-289 ref In FRENCH (For availability see N72-31043 22-03)

A logic circuit and its operational mode are described and a model for its active components chosen. Some methods for initializing the active component state variables are described. Verification is done by comparing the evolution of model parameters with that of parameters obtained digital simulation for the study of equivalent circuit parameter influence on the electrical behavior of the logic circuit by observing the energy dissipated during the commutation transients. ESRO

N72-31075 Christian Rovsing Ltd., Copenhagen (Denmark).

MAGNETIC FIELD INTERFERENCE OF dc/dc REGULATORS AND CONVERTERS FOR SATELLITES

G. Ekstrand, C. Overbeck, and A. Capel (ESRTC) *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 201-299 refs (For availability see N72-31043 22-03)

A variety of dc/dc regulators and coverters were examined with respect to magnetic field interference in the frequency range below 100 kHz. The magnetic field interference sources were studied and practical solutions were found for reduction of the fields from the various circuit components. A special self-compensating inductor design was developed to overcome the problems which arise for the inductive components. The results were applied to the design of an experimental PWM boost regulator for 100 W at 28 V. Convenient methods for measurement of the magnetic fields have been developed.

ESRO

N72-31076 European Space Research and Technology Center, Noordwijk (Netherlands).

ELECTROMAGNETIC INTERFERENCE STUDY OF MAGNETIC COMPONENTS CONTAINED WITHIN dc/dc CONVERTERS AND PWM REGULATORS

D. M. OSullivan *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 301-307 refs (For availability see N72-31043 22-03)

The magnetic fields due to the magnetic components contained within conventional dc/dc converters (containing power transformers) and PWM energy storage regulators (containing energy storage inductors) are studied. The study is limited to leakage fields due to imperfections in the windings of magnetic components using cores of uniform permeance. It is concluded that a first approximation approach indicates that for the same application a dc/dc converter will tend to generate more leakage flux than a PWM regulator. ESRO

N72-31077 Fabrica Italiana Apparecchi Radio S.p.A., Milan (Italy).

SOLAR ARRAY SIMULATOR

R. Formica *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 309-314 (For availability see N72-31043 22-03)

Three possible design approaches for solar array simulators to be used during ground tests on satellite power systems conditioning electronic are described. The first two designs have already been manufactured and used: the first one in the development tests of the ELDO-PAS launcher and the Sirio satellite power system, and the second for testing the ESRO-4 power system. The third is a modification of the second. In the design the following major points have been considered: (1) simulation of the V/I characteristic as close as possible to the effective solar array characteristic; (2) full manual regulation of short-circuit current, open-circuit voltage and output resistance in the voltage mode operation; (3) modularity, in order to combine a certain number of solar array panels in series or paralleled to reach the required power levels; (4) dc and ac impedance as close as possible to the actual solar panels; and (5) capability of short-circuit current modulation to simulate eclipse input and output or boom shadows; this modulation is to be obtained by means of external signals (voltage or current). Author (ESRO)

N72-31078# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

ELECTRO-BALLISTIC GENERATOR SYSTEM Final Report

Siegfried H. Hasinger Dec. 1971 57 p refs
(AF Proj. 7116)
(AD-740551; ARL-71-0322) Avail: NTIS CSCL 01/2

An EFD-generator system is described which utilizes the electro-ballistic conversion principle in a high-pressure environment. A special process is employed to produce massive charged particles for an effective ballistic process. A stream of droplets produced by a spray nozzle and containing colloidal material is first charged by induction. The droplets are then subject to evaporation with the electric charges transferring to the non-evaporating colloids. In a subsequent supersonic expansion process these charged colloids are used as condensation nuclei to produce charged droplets which are substantially larger than condensation droplets originating from spontaneous condensation, i.e., from an unseeded vapor. Water vapor near critical vapor conditions is used in the present system with particular advantages as operating medium. Author (GRA)

N72-31079# Georgetown Univ., Washington, D.C. Dept. of Chemistry.

THE ROLE OF THE ELECTRON IN BATTERIES AND FUEL CELLS Final Scientific Report, 1 Aug. 1967 - 31 Dec. 1971

Robert DeLevie 27 Mar. 1972 10 p refs
(Grant AF-AFOSR-1344-68; AF Proj. 9536)
(AD-740616; AFOSR-72-0868TR) Avail: NTIS CSCL 07/4

The report briefly summarizes the author's research results obtained in four different areas of electrochemical research: photo-emission of electrons from electrodes immersed in aqueous solution; electrocatalysis by anions adsorbed on electrodes; electrochemical theory; and membrane bio-electrochemistry. In all four areas, significant and novel contributions have been made. Author (GRA)

N72-31080# Varo, Inc., Santa Barbara, Calif. Electrokinetics Div.

DEVELOPMENT OF GENERATOR, DIRECT CURRENT G-63( )/G AND G-67( )/G Final Report, Nov. 1969 - Jan. 1972

Richard S. Bovitz May 1972 41 p
(Contract DAAB07-70-C-0075; DA Proj. 1H6-64710-D-535)
(AD-743216; ECOM-0075-F) Avail: NTIS CSCL 10/3

The development of Generators, Direct Current G-63( )/G and G-67( )/G has resulted in optimum, portable, lightweight, 30-watt generator units. The G-63 is capable of charging a 10 cell-12 volt nickel-cadmium battery and the G-67 is capable of charging a 20 cell-24 volt nickel-cadmium battery by hand cranking input with nominal effort within the limits of operator endurance. It encompasses maximum utilization of factors contributing to operating efficiency. Author (GRA)

N72-31081# Army Missile Command, Redstone Arsenal, Ala.

SYSTEM FOR MEASUREMENT OF RESPONSE TIME OF HIGH CURRENT INTERRUPTION COMPONENTS

Ray Straits Jul. 1971 13 p refs
(AD-742670) Avail: NTIS CSCL 14/2

A method is discussed for providing a controllable high current source which is applied to circuit protective and control devices for the determination of their surge and/or maximum interrupt capability and response time. Author (GRA)

N72-31082# Army Foreign Science and Technology Center, Charlottesville, Va.

SERIES OF NO-CONTACT SYNCHRONOUS GENERATORS WITH OUTPUTS UP TO 100 kV FOR WIND DRIVEN ELECTRIC UNITS

L. D. Urusov, V. S. Ryzhkov, L. A. Zilbershtein, and V. K. Volchkov 7 Oct. 1971 12 p refs Transl. into ENGLISH from Elektrotekhnika (USSR), no. 1, 1970 p 56-58
(AD-742641; FSTC-HT-23-1434-71) Avail: NTIS CSCL 10/2

The need for design of a specialized series of no-contact synchronous generators with outputs up to 100 kV for wind-driven electric units and the basic technical characteristics of the series of generators are discussed. Author (GRA)

N72-31083# Army Foreign Science and Technology Center, Charlottesville, Va.

SEMICONDUCTOR SOLAR ENERGY CONVERTERS AND THE PHENOMENON OF PHOTO CONDUCTIVITY QUENCHING

M. S. Isamukhamedora and P. M. Karageorgiy-Alkalayev 1 Feb. 1972 8 p refs Transl. into ENGLISH from Geliotekhnika, Akad, Nauk Uz. SSR (Tashkent), no. 3, 1970
(AD-743031; FSTC-HT-23-1577-71) Avail: NTIS CSCL 20/12

A semiconductor model with two impurity levels exchanging current carriers is analyzed to determine the conditions for the occurrence of photoconductivity quenching. The effects of this phenomenon on efficiency are described. Author (GRA)

N72-31084# Union Carbide Corp., Cleveland, Ohio. Consumer Products Div.

LOW COST OXYGEN ELECTRODES Interim Report, 11 May 1971 - 14 Jan. 1972

K. V. Kordesch and R. F. Scarr Apr. 1972 76 p refs
(Contract DAAK02-71-C-0297; DA Proj. 1T6-11102-A-34)
(AD-743189; IR-1) Avail: NTIS CSCL 10/2

The purpose of the research was the development of a low cost air electrode for medium temperature (130 C) immobilized phosphoric acid (matrix) fuel cell. Thin carbon electrode structures were fabricated and catalyzed with the minimum amount of platinum which produced a H2-air cell performance of 0.6-volt cell terminal voltage at 80 mA/sq cm, after 500 hours operation. By using special techniques of electrode manufacturing and catalyst application, a reduction of the Pt amount to a level of 1 to 2 mg Pt/sq cm was accomplished. A level of electrode performance near to the contract goals has been achieved. Other aspects of this investigation, such as analytical techniques and kinetic studies, are also discussed. Author (GRA)

N72-31085# Whiteley Industries, Inc., Wilmington, Mass.

FUEL CELL ELECTRODES (HYDROGEN-AIR) Final Report

R. E. Salathe May 1972 60 p
(Contract DAAB07-70-C-0127; DA Proj. IT6-62705-A-053)
(AD-742732; ECOM-0127-F) Avail: NTIS CSCL 10/2

The report describes the design and evaluation of a hydrogen-air fuel cell module for use in a portable hybrid fuel cell-battery system. The fuel cell module consists of a stack of 20 single assemblies. Each assembly contains 2 electrically independent cells with a common electrolyte compartment. When supplied with hydrogen, as generated from Sodium Aluminum Hydroxide, the module is capable of delivering in excess of 60 watts at a nominal output of 15 volts. Dry weight of the module assembly is 4.2 pounds. Electrolyte reservoir capacity is 250 cc, utilizing 3 to 6 molar potassium hydroxide. Author (GRA)

N72-31086# Army Foreign Science and Technology Center, Charlottesville, Va.

GENERALIZED RELATIONS FOR DETERMINATION OF OPTIMAL OPERATING MODE OF THERMOELECTRIC GENERATOR

R. V. Kovalskii 17 Apr. 1972 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Energ. i Transp. (Moscow), no. 3, 1970 p 160-164
(AD-742644; FSTC-HT-23-679-72) Avail: NTIS CSCL 10/2

Generalized dependences are concluded for optimal values of load factor m of a thermoelectric generator (TEG). The dependences can be used for generators with constant temperatures of thermocouple junctions, constant heat flux or constant heat transfer medium temperatures (mean or at input to generator) either with or without heat leaks through insulation between thermocouples. GRA

N72-31087# Army Foreign Science and Technology Center, Charlottesville, Va.

HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE

V. N. Komashchenko, A. I. Marchenko, and G. A. Fedorus 18 Jan. 1972 13 p refs Transl. into ENGLISH from Sb. Poluprov. Tekh, Microelektron. Resp. Mezhvedomstvennyi (Kiev), no. 4 p 112-121
(AD-743061; FSTC-HT-23-1432-71) Avail: NTIS CSCL 10/2

Data are presented on development and studies of photoelectric converters based on CdS and CdSe, as well as some more detailed data on the photoelectric convertors based on CdSe films. Author (GRA)

N72-31088# Battelle Memorial Inst., Columbus, Ohio.

DEPTHS OF DISCHARGE FOR ACCELERATED LIFE TESTS OF CADMIUM ELECTRODES

Allan H. Reed and John McCallum Wright-Patterson AFB, Ohio AFAPL May 1972 51 p refs
(Contract F33615-69-C-1537; AF Proj. 3145)
(AD-743017; AFAPL-TR-72-20) Avail: NTIS CSCL 10/3

Physical and chemical changes that occur in cadmium electrodes have been studied as a function of their depth of discharge and number of cycles. The electrodes were examined after removal from cycling by metallographic techniques, by chemical analysis for cadmium and cadmium hydroxide, and by measurements of electrochemical capacity after cycling. The results show that greater losses of capacity occur at greater depths of discharge and after greater number of cycles. The losses of capacity appear to be related to structural changes in the cadmium deposits in the porous electrode. The results of the chemical analyses show that essentially all of the cadmium remains within the electrode during cycling except at extreme depths and numbers of cycles. Author (GRA)

N72-31089# Army Foreign Science and Technology Center, Charlottesville, Va.

IMPROVEMENT OF CERTAIN OPERATIONAL CHARACTERISTICS OF SILVER-ZINC STORAGE BATTERIES

V. V. Romanov 19 Jan. 1972 11 p Transl. into ENGLISH from Vestn. Elektroprom. (Moscow), v. 31, no. 9, 1966 p 26-29
(AD-742887; FSTC-HT-23-1563-71) Avail: NTIS CSCL 10/3

Results are presented of an investigation of the possibilities for improvement of certain operational characteristics of silver-zinc batteries by charging these batteries with asymmetrical commercial frequency alternating current. Author (GRA)

N72-31090# Naval Research Lab., Washington, D.C.

NRL VAN DE GRAAFF OPERATION, 1 JANUARY - 31 DECEMBER 1971 Interim Report

K. L. Dunning Mar. 1972 86 p refs
(RR Proj. 002-09-41-5676; RR Proj. 007-08-44-5514; RR Proj. 002-06-41-5012)
(AD-743883; NRL-MR-2438) Avail: NTIS CSCL 20/7

The report is the 7th in a series of summaries on the use of

the NRL 5-MV Van de Graaff accelerator and associated instruments. The first six were semiannual summaries; this report is an annual summary for the period 1 January to 31 December 1971. Author (GRA)

N72-31091# Yardney Electric Corp., Pawcatuck, Conn.
DEVELOPMENT OF BATTERY, BA 536( )/U 150 AMP HOUR (ADVANCED DEVELOPMENT ENGINEERING DESIGN TYPE) Final Report
Sandy Seidman Mar. 1972 54 p
(Contract DAAB07-70-C-0019; DA Proj. 1G6-63702-DG-10)
(AD-743214; ECOM-0019-F) Avail: NTIS CSCL 10/3

The report describes the design, development, fabrication, and delivery of Battery BA-536( )/U 150 ampere hour. This is a six volt, 150 ampere hour mechanically rechargeable zinc air battery. The battery makes use of the bicell (dual cathode) system and is designed to be recharged by replacement of spent anodes with fresh anodes and addition of water. The first group of batteries were rejected because of observed performance deficiencies. Changes, coupled with backup data, are discussed. Author (GRA)

N72-31092# National Academy of Sciences-National Research Council, Washington, D.C. Board on Science and Technology for International Development.
SOLAR ENERGY IN DEVELOPING COUNTRIES: PERSPECTIVES AND PROSPECTS
Mar. 1972 60 p refs
(Contract AID/csd-2584)
(PB-208550; TA/OST-NAS-72-34) Avail: NTIS HC $4.50 CSCL 10A

This is a report of an ad hoc advisory panel, made up of specialists from the United States and abroad, to: (1) assess the state of the art in utilizing solar energy for developing countries and review current practical applications; (2) identify promising areas for research and development; and (3) examine the desirability of establishing an international solar energy institute in North Africa, to carry out solar energy research and development. GRA

N72-31093# Tyco Labs., Inc., Waltham, Mass.
LOW TEMPERATURE ELECTROCHEMICAL SYSTEM Semiannual Technical Report, 1 Jul. - 31 Dec. 1971
Paul A. Malachesky and Kathleen Cahill May 1972 61 p refs
(Contract DAAB07-71-C-0291)
(AD-742720; C-153; ECOM-0291-1; SATR-1) Avail: NTIS CSCL 10/3

Studies have been carried out on the factors influencing low temperature operation of air electrodes in metal-air batteries (such as zinc-air). Using a typical Teflon-bonded platinum black electrode structure, the pertinent parameters which describe the temperature dependence of the electrochemical and transport processes have been determined in 31% KOH electrolyte. The temperature could lead to problems in low temperature operation of zinc-air cells. Comparisons of the low temperature operation of different air electrode materials have revealed a distinct dependence of the transport-limited current on electrode structure, indicating a possible approach to improved low temperature operation of air electrodes via modifications in air electrode structure. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-31094*# George Washington Univ., Washington, D.C. Biological Sciences Communication Project.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN THE PUBLIC SECTOR Semiannual Review of the Biomedical and Public Sector Technology Application Team Program, 1 Jun. - 30 Nov. 1971
Todd Anuskiewicz, John Johnston, and Robert Zimmerman 30 Nov. 1971 129 p refs
(Contract NASw-2055)
(NASA-CR-128116; GW-BSCP-72-02R) Avail: NTIS HC $8.50 CSCL 06B

Current activities of the program to accelerate specific applications of space related technology in major public sector problem areas are summarized for the period 1 June 1971 through 30 November 1971. An overview of NASA technology, technology applications, and supporting activities are presented. Specific technology applications in biomedicine are reported including cancer detection, treatment and research; cardiovascular diseases, diagnosis, and treatment; medical instrumentation; kidney function disorders, treatment, and research; and rehabilitation medicine. F.O.S.

N72-31095# RAND Corp., Santa Monica, Calif.
THE SENSITIVITY OF PORTIONS OF THE HUMAN CENTRAL NERVOUS SYSTEM TO SAFE LEVELS OF MICROWAVE RADIATION
Robert M. Lebovitz Mar. 1972 34 p refs
(R-983-RC) Avail: NTIS HC $3.75

The possible biological effects of low level microwave (MW) radiation on the human organism are examined. A cursory examination of the direct effects of MW radiation reveals no mechanism by which low level exposure can produce significant changes. Heat effects exist which can be verified by careful measurement, but at neither the gross-tissue level nor the cellular level does 10 mW/sq cm of radiation appear to produce a significant thermal stress on the human. It was proposed that the human vestibular apparatus (the inner ear) may be responsive to low level MW radiation via indirect, caloric stimulation. To examine this possibility, a simplified mathematical model of induced temperature gradients in the vestibular apparatus was constructed. It appears that convective forces within the semicircular canals may generate sensible neural signals in response to MW irradiation at intensities as low as 10 mW/sq cm. Further experimentation using behavioral and direct neurophysiological techniques is now required to determine whether the predictions of this model have some validity. Author

N72-31096# Public Health Service, Washington, D.C. Injury Control Research Lab.
THE INFLUENCE OF SENSORY PATTERN AND ALCOHOL ON VEHICULAR VELOCITY SENSING
Santo Salvatore 1972 45 p refs
(ICRL-RR-70-8; DHEW(HSM)-72-10003) Avail: SOD

An investigation comparing the ability of subjects to judge travelled vehicular velocity with and without alcohol is described. Auditory and visual cues to travelled velocity were presented alone and in combination. The time that these cues were operative was varied from 1/4 to 1 second. The velocity factor was highly significant. Velocity estimates were compressed by velocity sequence. Judgments following low speeds tended to overestimation, and those following high speeds tended to underestimation. Auditory stimulation yielded the most accurate velocity judgments, and visual stimulation the least accurate. Reduced observation time accentuates the overestimation of low velocities and the underestimation of high velocities. This effect of time on velocity is potentiated by alcohol. Both reduced observation time and alcohol lessen the correlation between the judgment and its physical counterpart or both alcohol and reduced observation time increase the quessing that takes place. Under the influence of alcohol, when bisensory information is presented, a definite trend appears to evaluate only the auditory input. This selection of the auditory input for evaluation is interpreted as a primitivization of the sensory attention mechanism rather than the employment of a strategy. Author

N72-31097# Institut Franco-Allemand de Recherches, St. Louis (France).
AUDITORY LOSS AND RECUPERATION OF GUINEA PIGS AFTER EXPOSURE TO A SONIC BOOM. SONIC BOOM PRODUCED BY THE ISL GENERATOR. [PERTE AUDITIVE ET RECUPERATION CHEZ LE COBAYE APRES EXPOSITION A UN BANG SONIQUE. BANG PRODUIT PAR LE GENERATEUR DE L'ISL]
R. Franke, C. Lursat, and G. Evrard 26 Oct. 1971 25 p In FRENCH
(Contract DRME-71.34.445)
(ISL-35/71) Avail: NTIS HC $3.25

The auditory loss threshold provoked by the TSS Concorde sonic boom N-type shock wave is evaluated from guinea pig auditory reflexes. An audiometric method based on the Preyer reflex threshold measurement was used. The experimental results show that a slight and temporary effect is noticeable for a 40 m/bar pressure wave (40 times more intense than the sonic boom). ESRO

N72-31098# Institut Franco-Allemand de Recherches, St. Louis (France).
AUDITORY LOSS AND RECUPERATION OF GUINEA PIGS AFTER EXPOSURE TO SHOCK WAVES WITH RECTANGULAR PROFILE [PERTE AUDITIVE ET RECUPERATION CHEZ LE COBAYE APRES EXPOSITION A DES ONDES DE CHOC A PROFIL RECTANGULAIRE]
R. Franke, C. Lursat, G. Evrard, and F. Devriere [1972] 25 p refs In FRENCH
(Contract DRME-70.197)
(ISL-3/72) Avail: NTIS HC $3.25

Guinea pigs were subjected to rectangular shock waves of constant duration (12 m sec) generated by a shock tube to study the active role of different parameters which characterize the shock wave (gun noise, etc.). The time evolution of guinea pig auditory loss was followed using an audiometric method based on the Preyer reflex threshold measurement. It is shown that for an over pressure of 50 m bar, slight and temporary auditory loss was noticeable. However, for a double over pressure, the loss was of 16 db for the 16 kHz frequency and the recuperation after four weeks was only partial. ESRO

N72-31099# Newark Coll. of Engineering, N.J. Dept. of Mechanical Engineering.
APPARENT VISCOSITIES OF WHOLE BLOOD SYSTEMS AT MODERATE PRESSURE Final Report
A. L. Copley, R. M. Jacobs, and J. L. Martin Apr. 1972 18 p
(Contract N00014-71-A-0124)
(AD-740853) Avail: NTIS CSCL 06/16

Experiments are summarized which present evidence that the apparent viscosity of blood is unlikely to vary significantly with hydrostatic pressures to pressures of 775 psi (fifty atmospheres). GRA

N72-31100# Navy Medical Neuropsychiatric Research Unit, San Diego, Calif.
RECENT TECHNICAL REPORTS AND PUBLICATIONS
1 May 1972 14 p refs
(AD-741951) Avail: NTIS CSCL 06/5

A bibliography of reports in psychiatry, psychology and related subjects is presented. GFA

N72-31101# Naval Aerospace Medical Research Lab., Pensacola, Fla.
FOREHEAD SWEATING DURING MOTION SICKNESS
Joseph A. McClure and Alfred R. Fregly 7 Feb. 1972 12 p refs
(AD-743075; NAMRL-1157) Avail: NTIS CSCL 06/19

Forehead sweating was monitored on fifteen subjects during the elicitation of motion sickness by vestibular stimulation. An Electrochemical sweat sensor and a skin-resistance technique were used simultaneously to detect the sweat responses. None of the subjects showed any arousal type sweat responses at the time of onset of the vestibular stimulation. Two of the subjects showed no evidence of any forehead sweating despite an advanced degree of nausea. For the remaining thirteen subjects, a forehead sweat response was obtained after a latent period that ranged anywhere from 5 seconds to 4 minutes. Once initiated, the response tended to increase in magnitude as long as the stimulus was continued. This pattern of response is characteristic of most motion-sickness symptomatology. For certain subjects the forehead sweat response was compared with their dorsal-hand response obtained from a previous run carried out under the same standard conditions. These comparisons suggest that the forehead is a less active sweat area than the dorsal hand during motion sickness. Author (GRA)

N72-31102# Naval Aerospace Medical Research Lab., Pensacola, Fla.
EFFECT OF ENVIRONMENTAL TEMPERATURE ON SWEAT ONSET DURING MOTION SICKNESS
Joseph A. McClure and Alfred R. Fregly 6 Feb. 1971 20 p refs
(AD-740801; NAMRL-1153) Avail: NTIS CSCL 06/19

Since the sweat response is observed as part of some motion-sickness-rating procedures, it is useful to know if other variables such as environmental temperature can affect the response during vestibular stimulation on several occasions. On each occasion the run was carried out with a different environmental temperature. At a relatively high temperature the thermal stress caused a sweat response, and no vestibular stimulation was required. With lower environmental temperatures, a longer period of vestibular stimulation was required to evoke the sweat response. At a relatively low temperature no sweating was observed despite continuous vestibular stimulation and the development of severe nausea. The results indicate that environmental temperature can affect the sweat response during motion sickness and suggest the possible hazard of excessive fluid and electrolyte loss when both vestibular and thermal stress are present. By proper selection of environmental temperature, sweating can be induced before the onset of nausea. In this situation the sweat response could serve as a useful predictor of motion-sickness onset in the administration of adaption schedules and in monitoring persons in the space-flight environment.
Author (GRA)

N72-31103# Naval Aerospace Medical Research Lab., Pensacola, Fla.
REVISED NORMATIVE STANDARDS OF PERFORMANCE OF MEN ON A QUANTITATIVE ATAXIA TEST BATTERY
Alfred R. Fregly, Margaret J. Smith, and Ashton Graybiel 15 Mar. 1972 19 p refs
(AD-743074; NAMRL-1160) Avail: NTIS CSCL 06/16

Revised normative standards of performance of men, ages 16-60 years, on a quantitative ataxia test battery in terms of new chronological age groupings based on a sample of 1055 normal men are presented. Five age groups--16-30, 31-40, 41-45, 46-50, and 51-60 years--were found to be required to reduce the correlation with age to a nonsignificant level. All subtests of the battery, except Walk On Floor Eyes Closed (WOFEC), were very nearly similar in sensitivity to aging influences, implying a reliably unitary sensitivity of the battery to aging influences on the complex postural equilibrium functions sampled by it. Present findings tentatively suggest that the negative aging influences become apparent several years earlier than reported previously (within the age range of 31-40 years rather than 43-50 years). The progressive nature of this aging influence along the life span sampled is similar to that previously reported on women. The new normative standards should allow more precise laboratory and clinical applications of the test battery which has proved to be useful particularly in the vestibular physiological and neuro-otological assessment of postural equilibrium-disequilibrium, including spontaneous and induced vestibular ataxia. The test battery has other clinical and/or research applications. Author (GRA)

N72-31104# Navy Medical Neuropsychiatric Research Unit, San Diego, Calif.
MOTIVATION, COGNITION, AND SLEEP WORK FACTORS; CENTRAL AND AUTONOMIC NERVOUS SYSTEM INDICES
Laverne C. Johnson, H. L. Williams, and J. A. Stern 1972 15 p refs Repr. from "Human Factors in Long Duration Space Flight" Washington, Natl. Acad. of Sci., 1972 p 108-130
(AD-741939; NMRU-72-13) Avail: NTIS CSCL 06/16

Possible problems for human performance in relation to three factors, motivation, cognition, and sleep, are discussed. Of particular concern in the discussion are possible alterations in cycles of sleeping and waking, and in physiological patterns of sleep and the potential effects of such changes on vigilance, memory, problem solving, and motivation. An attempt is also made to anticipate the effects of prolonged spaceflights on the central and autonomic nervous systems. Author

N72-31105# School of Aerospace Medicine, Brooks AFB, Tex.
DEVELOPMENT OF REALISTIC A WEIGHTED AUDITORY RISK CRITERIA FOR AEROSPACE OPERATIONS Progress Report, Nov. 1970 - Aug. 1971
Donald C. Gasaway and Harrell C. Sutherland, Jr. Dec. 1971 22 p refs
(AF Proj. 7755)
(AD-743298; SAM-TR-71-47) Avail: NTIS CSCL 06/19

The authors have previously proposed adoption of the CHABA Working Group 46 criterion for steady-state noises to assess degrees of auditory risk associated with aerospace operations. In this report, the salient features of various damage risk criteria are reviewed and primary and secondary compromises are discussed. A simple criterion using A-weighted sound levels is proposed for broad-band and narrow-band steady-state and intermittent noise and for impact noises. The criteria contained in this report provide guidance needed to identify potentially hazardous exposures encountered in aerospace operations.
Author (GRA)

N72-31106# Naval Medical Research Inst., Bethesda, Md.
DIFFERENTIAL BEHAVIORAL EFFECTS OF BREATHING AIR AND HELIUM-OXYGEN AT THREE TO TEN ATMOSPHERES Medical Research Progress Report
John R. Thomas and Arthur J. Bachrach 30 Dec. 1971 22 p refs
(MF12524004)
(AD-741691; NAVMED-MF12.524.004-7007D-2) Avail: NTIS CSCL 06/19

A multiple schedule of reinforcement, consisting of a fixed-ratio (FR) schedule and a fixed-interval (FI) schedule, was used as an ongoing behavioral baseline to measure differential gas and depth effects on pigeons. Measurements were taken at depths of 66, 99, 200, and 300 feet. An 80% helium-20% oxygen mixture was found to have less disruptive effects than air on pigeons responding on the two different schedules particularly at 200- and 300-foot depths. Repeated exposure to pressure, independent of gas mixture or depth, resulted in a gradual behavioral adaptation measured by a reduction in the disruption of behavior. Author (GRA)

N72-31107# Naval Training Device Center, Orlando, Fla.
VISION TESTS USING LASER SPECKLE
Windell N. Mohon and Alfred M. Rodemann 11 Apr. 1972 16 p refs
(AD-742792; NAVTRADEVCEN-TN-34) Avail: NTIS CSCL 06/5

A method is described for testing myopic, hyperopic, emmetropic, and astigmatic vision using the speckle patterns of a laser. The tests significantly reduce the subjective judgments required of a patient. The subject does not need to know how to read; hence, young children and possibly laboratory animals could be tested. Results of laboratory tests are discussed. A physical system to implement the testing method is described. This testing method is extended to include measurements of required corrective power and the accommodative response at wavelengths throughout the visible spectrum. Author (GRA)

N72-31108# Navy Medical Neuropsychiatric Research Unit, San Diego, Calif.
A GENERALIZATION OF HARMONIC ANALYSIS FOR DETECTION OF LONG-PERIOD BIORHYTHMICITIES FROM SHORT RECORDS
Cyril Nute and Paul Naitoh 1971 24 p refs
(MF12524004)
(AD-741211; NMNRU-71-55) Avail: NTIS CSCL 06/16

Successive ordinates of the line spectrum as computed by means of the discrete Fourier transform indicate how the variance of a given time series is apportioned among the members of a set of orthogonal, i.e. harmonic, frequencies. The continuous Fourier transform provides a means of interpolation between these frequencies. However, when the original data include a long-period sinusoid whose frequency is below the fundamental, then neither the discrete nor the continuous Fourier transform gives a good indication of the presence of long-period wave function. The detection and estimation of such a function can be accomplished by a generalization of harmonic analysis along the framework of regression analysis. The procedure computes a squared multiple correlation coefficient corresponding to any frequency, by regressing sine and cosine weights on the observed data. The method and its applications are illustrated by simple numerical examples. Author (GRA)

N72-31109# Environmental Protection Agency, Rockville, Md. Twinbrook Research Lab.
MICROWAVE ENERGY ABSORPTION IN TISSUE
Richard A. Tell Feb. 1972 62 p refs
(PB-208233) Avail: NTIS HC $3.00 CSCL 06R

A guide to several dosimetric techniques used to study energy absorption in biological tissues is presented. A detailed account is given of the calculational concepts, gathered from the literature, which are used to determine the degree of power absorption within such tissue systems as well as the spatial distribution of this absorbed dose as heat and consequently, the tissue temperature elevations which may be experienced in the model. Both a graphic-analytic technique using the Smith chart and a mathematical derivation of the appropriate computing formulas are given. Adequate derivation of the appropriate computing formulas are given. Author (GRA)

N72-31110# Texas Technological Univ., Lubbock.
VALIDATION OF A QUICK, SUBMAXIMAL TEST OF MAXIMAL OXYGEN INTAKE Research Quarterly Report
Alfred Eugene Coleman Apr. 1972 18 p refs
(Contract DAAD05-69-C-0102)
(AD-743103) Avail: NTIS CSCL 06/16

The purpose of this study was to validate a submaximal treadmill test for prediction of maximal oxygen consumption in fifteen male college students. This objective was accomplished by comparing maximal oxygen intake values recorded during a maximal treadmill test with those predicted from the submaximal test. Comparisons were also made among the between the true and predicted values and those estimated from the Astrand-Rhyming nomogram. Application of the analysis of variance techniques indicated that no significant difference existed between the criterion and the two predictors. The average error of prediction; however, was 8 percent for the submaximal test and 15 percent for the nomogram. The results of the study indicated that the submaximal test yielded a valid estimate of maximal oxygen intake and is more accurate than several of the commonly used submaximal tests. Author (GRA)

N72-31111# Army Behavior and Systems Research Lab., Arlington, Va.
A COMPARISON OF TWO METHODS OF GISTING
Joyce L. House Nov. 1971 29 p refs
(AD-743185; BESRL-TRN-236) Avail: NTIS CSCL 05/10

An important segment of army research is concerned with human factors studies in communication analysis processing. The report is on two experimental methods of gisting - reporting in brief form the essential information in a communication - in

comparison with baseline performance in simulated on-line gisting. Twenty-four communications processors were each tested using two methods of gisting. In one method (free repeat), the processor listened once to the complete message with no option to stop or replay, preparing as complete a gist as possible, and was then free to replay the tape as he judged necessary to complete the gist. In the second method (forced repeat), the processor listened to the complete message five additional times with no option to stop or replay. The resulting gists were evaluated in terms of key items of information correctly reported, quality of gist as rated by four judges, and in the case of the free repeat method the number of times the tape was stopped and replayed in the gisting process. Author (GRA)

N72-3*112# Army Edgewood Arsenal, Md.
THE MEASUREMENT OF ENZYME KINETIC PARAMETERS OF POORLY SOLUBLE SUBSTRATES Technical Report, Nov. 1969 - Oct. 1971
George M. Steinburg, Norman C. Thomas, and Larrel W. Harris Apr. 1972 39 p refs
(AD-743176; EA-TR-4632) Avail: NTIS CSCL 06/1

A method is presented for determining enzyme kinetic constants using the full progress curve of conversion of substrate to products. Use is made of the integrated form of the Michaelis-Menten equation with correction for product inhibition. Satisfactory results were obtained with phenyl acetate (using the enzyme acetylcholinesterase). Two computer programs are appended. One is for the calculation of enzyme kinetic constants using the integrated form of the rate equation. The second program is for calculation of the kinetic constants from initial rate data using the Wilkinson weighted regression method. A convenient procedure is suggested for the preparation of selected alcohols and thiols of limited stability, as, for example, phenol and thiocholine. Author (GRA)

N72-31113# Human Engineering Labs., Aberdeen Proving Ground, Md.
DARK-ADAPTATION RECOVERY AFTER PULSED LIGHT
David J. Florip and Robert W. Bauer Apr. 1972 12 p refs
(AD-743164; HEL-TN-3-72) Avail: NTIS CSCL 06/16

Recovery of complete dark adaptation was observed after exposure to single pulses of light. Illuminances were measured at the subject's face, and durations ranged from 0.01 to 1.0 second. Subjects recorded their own recovery by adjusting an adaptometer to the lowest luminance detectable. Recovery times were sensitive to both duration and illuminance but varied most predictably with total light flux as measured in lumen-seconds. Author (GRA)

N72-31114# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
PARAMETERS OF HUMAN PATTERN PERCEPTION Semiannual Progress Report, 18 Sep. 1971 - 18 Mar. 1972
Selby H. Evans 18 Apr. 1972 27 p
(Contract DAAD05-68-C-0176; DA Proj. 1T0-61102-B-81A)
(AD-741396; SAPR-9) Avail: NTIS CSCL 05/10

Theoretical and methodological development were concentrated on the development of a model for human pattern perception and include: (1) the development of prototype and generation of sets of deviant examples of line drawings (insects) to be used with the model; (2) the operation of the model in a supervised learning mode to validate its pattern analytic routines and to obtain distributional statistics on the sets of examples; and (3) planning for the unsupervised learning mode in which the model will learn to recognize a new pattern on the basis of examples in which the classes are not identified for the model by the experimenter. Author (GRA)

N72-31115# Army Foreign Science and Technology Center, Charlottesville, Va.
STUDY OF THE DYNAMIC ACUITY OF VISION
M. G. Kozrkova 26 Jan. 1972 9 p refs Transl. into ENGLISH from Probl. Fiziol. Opt. (USSR), v. 15, 1969 p 138-141
(AD-741528; FSTC-HT-23-313-72) Avail: NTIS CSCL 06/16

Dynamic visual acuity is a complex form of interaction of the visual analyzer relative to the perception of moving objects. It is determined by the static visual acuity and the condition of the oculomotor apparatus. It depends on the rate of motion and tracking time of an object. Individual differences in dynamic visual acuity with the same static acuity indicate the desirability of using this test for selection of persons whose activity requires the perception of moving objects. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-31116*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRASONIC BIOMEDICAL MEASURING AND RECORDING APPARATUS Patent Application
Robert D. Lee, inventor (to NASA) Filed 18 Aug. 1972 23 p
(NASA-Case-ARC-10597-1; US-Patent-Appl-SN-281876) Avail: NTIS HC $3.25 CSCL 06B

An improved ultrasonic biomedical measuring and recording apparatus particularly useful for measuring and recording movements of organs such as heart walls or valves is described. The system includes an ultrasonic transducer for transmitting a probing beam of ultrasonic wave energy into the organ to be observed. Echoes from the organ are picked up by a transducer, amplified in a receiver and detected in an ultrasonic measuring circuit to derive an output proportional to the distance from the transducer to the organ under observation. This distance signal varies with movement of the organ and is recorded on a chart recorder as a function of time. The measuring and recording circuit includes an electronically-controlled gate (window), the time delay of the gate relative to the transmitter pulse being selected for observing desired echo signals. An automatic gate control circuit integrates the squared and gated echo signal over succeeding halves of the gate interval and subtracts one integral from the other to derive an error signal for centering the gate interval on the desired echo. NASA

N72-31117*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHOULDER HARNESS AND LAP BELT RESTRAINT SYSTEM Patent Application
Albert P. Garavaglia and Dennis S. Matsuhiro, inventors (to NASA) Filed 22 Aug. 1972 9 p
(NASA-Case-ARC-10519-1; US-Patent-Appl-SN-282738) Avail: NTIS HC $3.00 CSCL 06K

A description is given of a combination shoulder harness and lap belt restraint system. The lap belt is combined with the shoulder harness in such a manner that a single fastening mechanism suffices to fasten both the harness and belt around the body of the wearer. The restraint system is suitable for use in automobiles, aircraft, or other vehicles. NASA

N72-31118*# Clemson Univ., S.C. Dept. of Mechanical Engineering.
FEASIBILITY DEMONSTRATION OF A HYPERFILTRATION TECHNIQUE TO RECLAIM SHOWER WASTEWATER AT ELEVATED TEMPERATURES
J. C. Hester and C. A. Brandon Sep. 1972 24 p refs
(Contract NAS1-11297)
(NASA-CR-112127) Avail: NTIS; Office of Technical Services, Dept. of Commerce, Washington, D. C. 20230 $0.75 CSCL 06I

A feasibility demonstration of a hyperfiltration technique to determine its capability to reclaim shower wastewater at elevated

temperature was conducted. Approximately twenty (20) gallons of typical shower water were processed through a dynamically formed membrane at a temperature of 167 F. Chemical and bacterial analyses of the product water are presented which show compliance with all potable water requirements established for extended manned space missions. In addition, subsystem characteristics and capabilities are discussed. Author

N72-31119# Public Health Service, Washington, D.C. Injury Control Research Lab.
THE PERCEPTION OF REAL MOTION: A LITERATURE REVIEW
Santo Salvatore 1972 62 p refs
(ICRL-RR-70-7; DHEW(HSM)-72-10002) Avail: SOD $0.35

A survey of literature, both governmental and psychological publications, on real motion perception is presented. Data cover two aspects: (1) angular orientation of the moving object in relation to the observer's line of sight, and (2) eye movement activity the observer uses to evaluate the object motion. Also covered are presence or absence of reference points in the visual field, direct inferential dichotomy, and sensitivity of various portions of the visual field. E.H.W.

N72-31120# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE EFFECT OF PREVIEW ON PILOT DESCRIBING FUNCTIONS IN A SIMPLE TRACKING TASK
N. H. Drewell May 1972 40 p refs
(UTIAS-TN-176) Avail: NTIS HC $4.00

A preliminary analysis is presented of the pilot describing functions of six volunteer subjects found by using the new preview display at UTIAS. The tasks were pure pursuit tracking with rate control dynamics; the pilot being given a preview of the input signal. The amount of preview was varied between zero and 0.8 seconds and where possible, an 8-parameter theoretical pilot model was fitted to the describing function data in order to enhance the quantitative description of these functions. Author

N72-31121*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF THE VISUAL FIELD DEPENDENCY IN THE ERECT AND SUPINE POSITIONS
Jacob H. Lichtenstein and Rayford T. Saucer Washington Sep. 1972 75 p refs
(NASA-TN-D-6883; L-8315) Avail: NTIS HC $3.00 CSCL 05E

The increasing utilization of simulators in many fields, in addition to aeronautics and space, requires the efficient use of these devices. It seemed that personnel highly influenced by the visual scene would make desirable subjects, particularly for those simulators without sufficient motion cues. In order to evaluate this concept, some measure of the degree of influence of the visual field on the subject in necessary. As part of this undertaking, 37 male and female subjects, including eight test pilots, were tested for their visual field dependency or independency. A version of Witkin's rod and frame apparatus was used for the tests. The results showed that nearly all the test subjects exhibited some degree of field dependency, the degree varying from very high field dependency to nearly zero field dependency in a normal distribution. The results for the test pilots were scattered throughout a range similar to the results for the bulk of male subjects. The few female subjects exhibited a higher field dependency than the male subjects. The male subjects exhibited a greater field dependency in the supine position than in the erect position, whereas the field dependency of the female subjects changed only slightly. Author

N72-31122# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
A NONLINEAR MULTIPARAMETRIC HUMAN CONTROLLER MODEL
Gunnar Johannsen Jul. 1971 188 p refs In GERMAN
(FB-5) Avail: NTIS HC $11.50

A process is proposed which presents a systematic approach to the contradictions between the mathematical model representing man as part of a control system and the physiological aspects included in the model by developing and optimizing several models. Performance of this process is proved by developing a multiparameter nonlinear model and comparing this model with the well-known quasi-linear transfer function. Parametric optimization of the model depends on a random process and minimization of the difference between the input values given by the operator and the ones given by the model. Optimization in open and closed control systems is discussed. A nonlinear model is designed which represents the operator and takes into account not only visual but also proprioceptive information. A threshold device and a decision making algorithm is included in the program. Four different display configurations are discussed. A hybrid computer was used. ESRO

N72-31123# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SIMULATORS FOR MAN-VEHICLE SYSTEMS [SIMULATOREN FUER MENSCH-FAHRZEUG-SYSTEME]
K.-P. Gaertner and J. Wernicke Oct. 1971 96 p refs In GERMAN; ENGLISH summary
(FB-7) Avail: NTIS HC $7.00

The applications and technical development of simulators of man-vehicle systems are surveyed. The basic technical principles of the simulation of man-vehicle systems are outlined and discussed. Training, development, and research simulators are distinguished. The mode of operation and the realism of simulators are considered. Concepts of visual simulation are mentioned. Author (ESRO)

N72-31124# Istituto di Fisica Dell Atmosfera, Rome (Italy).
RANGE OF VISIBILITY OF AN OBJECT IN THE ATMOSPHERE [PORTATA VISUALE DI UN OGGETTO ATTRAVERSO L'ATMOSFERA]
M. Gazzi and V. Vicentini Apr. 1972 38 p refs In ITALIAN
(IFA-SR-36) Avail: NTIS HC $4.00

The visual field of an object in the earth atmosphere is presented, based on the elementary theory of optics and the attenuation of light transmission in the air, and the contrast threshold of the human eye. Finally the visual field is computed using the Koschmieden and Allard equations. ESRO

N72-31125# Istituto di Fisica Dell Atmosfera, Rome (Italy).
BIBLIOGRAPHY ON VISIBILITY (1958 1970) [BIBLIOGRAFIA "VISIBILITA" (1958 - 1970)]
M. Gazzi, G. Simonini, and V. Vicentini Jan. 1972 59 p refs In ITALIAN Prepared jointly with Aeron. Mil. Ital.
(IFA-STR-17) Avail: NTIS HC $5.00

A bibliography from 1958 up to 1970 is presented on visibility problems relating to air navigation, runway visual fields, and visual field of objects in the atmosphere. Problems such as psychophysical effects of luminous intensity and color on the human eye and effect of low visibility conditions on the pilot's landing maneuver are also included. ESRO

N72-31126# Electronic Systems Div., Bedford, Mass.
MINUTEMAN PERSONNEL SELECTION STUDY
William H. Hendrix Mar. 1972 21 p refs
(AD-740841; ESD-TR-72-140) Avail: NTIS CSCL 05/9

The report deals with the selection of personnel for assignment as Minuteman Missile Combat Crew Members. The data evaluated consists of biographical data, Officer Efficiency Reports, and Air Training Command Standard Scores obtained on individuals during individual missile training. Two predictors of performance were isolated using a multiple regression technique, which incorporated the use of dummy variables. The importance of this study, however, is not limited only to those variable found to be significant. In fact, an example cited in the study indicates that certain variables which are not predictive of success could

have an equally important managerial implication. It is recommended that future research be undertaken to evaluate ORT scores, AFOQT scores, and other pre-service variables such as Grade Point Average as possible predictors. Author (GRA)

N72-31127# Emory Univ., Atlanta, Ga. Regional Rehabilitation Research and Training Center.
RESEARCH ON ACQUISITION OF SKILLS WITH SINGLE MOTOR UNIT TRAINING AND EEG Annual Report
John V. Basmajian and William D. McLeod 31 Mar. 1972 10 p
(Contract DADA17-70-C-0105)
(AD-740824; AR-2) Avail: NTIS CSCL 05/10

An experiment based on several pilot studies was defined to investigate the sensory input, motor output correlation within a single motor unit control task using EEG as the indicator of both sensory and motor response. Author (GRA)

N72-31128# School of Aerospace Medicine, Brooks AFB, Tex.
PULSE COUNT AUDIOMETRIC EQUIPMENT: NEW ELECTROMECHANICAL AND DIGITAL ELECTRONIC APPROACHES Final Report, Nov. 1967 - Jan. 1971
Francis A. Brogan Apr. 1972 15 p refs
(AD-742973; SAM-TR-72-9) Avail: NTIS CSCL 06/12

Two types of devices which may be used in producing pulse trains for pulse count audiometry are described. The electromechanical model, while simple to understand, has disadvantages such as adjustment problems and it produces acoustic and electrical noise. The digital electronic model eliminates these problems and costs less to construct. The digital approach using integrated circuits offers unusual flexibility for interfacing audiometers with computing equipment.
Author (GRA)

N72-31129# Naval Submarine Medical Center, Groton, Conn.
SUBMARINE CREW EFFECTIVENESS DURING SUBMERGED MISSIONS OF SIXTY OR MORE DAYS DURATION Interim Report
Benjamin B. Weybrew 28 Oct. 1971 29 p refs
(AD-740796; NSMRL-686) Avail: NTIS CSCL 05/10

The primary objective of the study was to integrate that segment of the literature of submarine psychology which focusses upon the major factors affecting submarine crew-member effectiveness during prolonged submergence. First, the most significant submarine stressors were delineated together with the specific adaptive processes correlated with them. These were found to be: confinement, revitalized air, flattening of circadian rhythms, threat of hyperbaric exposure and sleep deprivation. Performance decrements, incidence of debilitating morbidity (including psychopathology), and decompensatory trends in crew morale appeared to be minimal during long cruises. In general, the impressions from this integrative review of this rather-specialized literature is that the habitability situation in the submarine service continues to be optimal, in part because of the effective psychiatric screening procedures in force, but also as a result of the quality of leadership demonstrated by the officers and petty officers making up the crews of the submarines in the fleet. Author (GRA)

N72-31130# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AN ANNOTATED BIBLIOGRAPHY OF UNITED STATES AIR FORCE APPLIED PHYSICAL ANTHROPOLOGY Bibliography, Jan. 1946 - Mar. 1972
Rena Kimbrough, comp. Mar. 1972 61 p refs
(AF Proj. 7284)
(AD-743029; AMRL-TR-71-15) Avail: NTIS CSCL 05/5

The report contains the titles, authors, publication/source information, and the abstracts of 122 technical reports and articles published by Anthropology Branch of the Aerospace Medical Research Laboratory between January 1946 and March 1972. It is a detailed document of the scope of the effort of the Air Force in the field of applied physical anthropology to provide the information on human body size and biomechanical characteristics of Air Force personnel required for the development and evaluation of Air Force systems, personal-protective equipment and clothing. Author (GRA)

N72-31131# Army Aeromedical Research Lab., Fort Rucker, Ala.
VIETNAM RETURNEE SURVEY
Kurt E. Lidke, Mark A. Hofmann, and Andrew S. Martin Mar. 1972 24 p refs
(AD-742665; USAARL-72-12) Avail: NTIS CSCL 05/9

The paper presents some results of a questionnaire given to 300 Army aviators who served in the Republic of Vietnam. The questions analyzed were primarily those concerned with work patterns, physical conditions, medical care, groundings and accidents. GRA

N72-31132# Human Resources Research Organization, Alexandria, Va.
TRANSFER OF INSTRUMENT TRAINING AND THE SYNTHETIC FLIGHT TRAINING SYSTEM
Paul W. Caro Mar. 1972 12 p refs Presented at the Naval Training Device Center and Ind. 5th Conf., Orlando, Fla., Feb. 1972
(Contract DAHC19-70-C-0012)
(AD-743155; HumRRO-PP-7-72) Avail: NTIS CSCL 05/9

One phase of an innovative flight training program, its development, and initial administration is described in this paper. The operational suitability test activities related to a determination of the transfer of instrument training value of the Army's Synthetic Flight Training System (SFTS) Device 2B24. Sixteen active Army members of an Officer Rotary Wing Aviator Course who had completed primary training and 9 Instructor Pilots participated in the study. Instrument training was conducted in the SFTS on a proficiency basis. Aircraft checkrides were administered by independent evaluator personnel. Checkride times and grades showed that much of the training now conducted in aircraft could be conducted more efficiently on the ground. Author (GRA)

N72-31133# Army Foreign Science and Technology Center, Charlottesville, Va.
PARACHUTE OXYGEN APPARATUS
7 Apr. 1972 6 p Transl. into ENGLISH from Krylya Rodiny (Moscow), no. 4, 1969 p 28
(AD-743039; FSTC-HT-23-603-72) Avail: NTIS CSCL 06/11

The KP23 is designed to supply oxygen during jumps of no higher than 14,000 meters. It can also be used as a reserve until descent to a safe altitude (4,000 m) in the event the flight oxygen apparatus fails. The parachutist is automatically disconnected from the flight oxygen system and switched to the individual apparatus. The KP23 can be used with any type of parachute having special packs for the apparatus. Preflight checkout instructions are given. Author (GRA)

N72-31134# Naval Submarine Medical Center, Groton, Conn.
MOTION PARALLAX AND ABSOLUTE DISTANCE Interim Report
Steven H. Ferris 22 Jul. 1971 15 p refs
(AD-742078; NSMRL-673) Avail: NTIS CSCL 05/10

The accuracy of absolute distance estimation based on monocular motion parallax was determined both before and after specific training. With the usual distance information eliminated, subjects either held their heads stationary or rhythmically rotated their heads from side to side while judging the distance of stimuli placed 4-15 ft. away. Before training, head movement produced more accurate judgments than head fixed. After only 10 training trials, accurate judgments based on motion parallax were obtained. Results with a textured background were better than results with a white background only when the subjects were not given any direct information about motion parallax.

Good results were also obtained for motion parallax relative to a near reference object (2.5 ft. away). The results indicate that motion parallax can be useful for absolute distance estimation, and they suggest that motion parallax would be useful in the underwater environment, where the usual sources of distance information are absent or distorted. Author (GRA)

N72-31135# National Society of Professional Engineers, Washington, D.C.
SKILLS CONVERSION PROJECT. CHAPTER 10: OCEAN ENGINEERING AND OCEANOGRAPHY Final Report
Mar. 1972 83 p refs
(Contract DL-11-1-0534-000)
(PB-209281-10; DLMA-EST-11-1-0534-000-10) Avail: NTIS CSCL 05I

A study of ocean-oriented industry in Florida and Southern California was conducted. The purpose was to determine the potential utilization of aerospace/defense technical professional manpower by those industries. Author (GRA)

N72-31136# Human Resources Research Organization, Alexandria, Va.
PERFORMANCE MEASUREMENT IN HELICOPTER TRAINING AND OPERATIONS
Wallace W. Prophet Apr. 1972 17 p refs Presented at the Am. Psychol. Assoc. 79th ann. meeting, Washington, D. C., Sep. 1971
(Contract DAHC19-70-C-0012)
(AD-743157; HUMRRO-PP-10-72) Avail: NTIS CSCL 05/9

For almost 15 years an active research program was conducted on techniques for measuring the flight performance of helicopter trainees and pilots. This program addressed both the elemental aspects of flying (i.e., maneuvers) and the mission- or goal-oriented aspects. A variety of approaches was investigated, with the stress on nonautomated techniques feasible for operational use. The paper describes the work and illustrates its application to and implications for training management, quality control, manpower resources management, and operational capability. Automated human performance monitoring in flight simulators and its implications for automated training is also described. Author (GRA)

N72-31137# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
A METHOD FOR MONITORING SYSTOLIC AND DIASTOLIC BLOOD PRESSURES ON A BEAT BY BEAT BASIS Final Report
Michael L. Rubinstein and Adolf F. Marko Mar. 1972 27 p
(AD-744003; AMRL-TR-70-47) Avail: NTIS CSCL 14/2

A system for measuring systolic and diastolic blood pressures on a beat by beat basis is described. The system input consists of only the amplified output of a pressure transducer. It operates over a range of 0-250 mm Hg, will satisfactorily trigger on pulse pressures from 5 mm Hg to 100 mm Hg, and is insensitive to wave shape or baseline changes. The theory of beat by beat measurement is discussed, several current methods are explained, and a new method is described in detail. A practical circuit is given along with the results of the operation of a prototype. Author (GRA)

N72-31138# Naval Coastal Systems Lab., Panama City, Fla.
A STUDY OF SEVERAL APPROACHES FOR SUPPLYING A DIVER WITH WARM BREATHING GAS
R. L. Bentz Apr. 1972 60 p refs
(AD-742080; NCSL-105-72) Avail: NTIS CSCL 06/11

Recent investigations have shown that a diver working in cold water below 500 feet for extended periods of time must be provided with a warm breathing gas. Several practical approaches for supplying the diver with a warm breathing gas were investigated. The approaches investigated were influenced by their applicability to the U. S. Navy scuba Mark-11. This system uses warm water to heat the diver, and, therefore, is the only heat source considered. A thermal analysis of the Mark-11 yields theoretical temperatures throughout the system for helium-oxygen gas mixture at 1000 feet and for air at surface pressure. The same analysis is made considering insulated system components. The other approaches investigated were a heat exchanger, heated breathing hose, and a heated back pack. The advantages and disadvantages of each approach are discussed. Author (GRA)

N72-31139# Systems Technology, Inc., Inglewood, Calif.
THE VOCAL ADAPTIVE CONTROLLER-HUMAN PILOT DYNAMICS AND OPINION
I. L. Ashkenas and D. T. McRuer 1972 8 p refs
(Contract AF 33(616)-5661)
(AD-742442) Avail: NTIS CSCL 05/10

The paper undertakes to examine the roots of pilot opinion from the standpoint of the dynamical system involved. By considering data which contain both pilot opinion and pilot performance in the dynamic output/input (transfer function) sense, it is shown that opinion is closely correlated with; the low frequency performance of the complete system including the pilot; and the quantitative manner in which the pilot must 'adapt' to the vehicle. The first of the above factors is related to the accuracy with which the pilot can control the vehicle; the second relates to the magnitudes of the gains, leads, and lags that the pilot generates. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-31140* Garrett Corp., Los Angeles, Calif.
PROCESS FOR SEPARATION OF DISSOLVED HYDROGEN FROM WATER BY USE OF PALLADIUM AND PROCESS FOR COATING PALLADIUM WITH PALLADIUM BLACK Patent
Charles F. Albright, inventor (to NASA) Issued 25 Jul. 1972 6 p Filed 17 Jul. 1970 Supersedes N70-36121 (08 - 19, p 3494) Sponsored by NASA
(NASA-Case-MSC-13335-1; US-Patent-3,678,654; US-Patent-Appl-SN-55806; US-Patent-Class-55-16; US-Patent-Class-55-55) Avail: US Patent Office CSCL 07A

Dissolved gaseous hydrogen in water is separated from the water by placing the water in contact with a thin metallic film of palladium or palladium-silver alloy, both sides of which film are coated with palladium black. The other side of the film has less pressure than the partial pressure of the hydrogen dissolved in the water. The hydrogen permeates the film and passes to the other side of it. Preferably the palladium black is applied to the metallic film by etching the film, rubbing palladium chloride powder on the film, reducing the palladium chloride to palladium black by exposing it to gaseous hydrogen, depositing additional palladium black from a palladium chloride solution and rubbing the palladium black coating to remove excess black, and provide a tightly bonded adherent coating.
Official Gazette of the U.S. Patent Office

N72-31141* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONDISPERSIVE GAS ANALYZING METHOD AND APPARATUS WHEREIN RADIATION IS SERIALLY PASSED THROUGH A REFERENCE AND UNKNOWN GAS Patent
John Dimeff, inventor (to NASA) Issued 25 Jul. 1972 9 p Filed 16 Apr. 1971 Supersedes N71-34090 (09 - 21, p 3386)
(NASA-Case-ARC-10308-1; US-Patent-3,679,899; US-Patent-Appl-SN-134568; US-Patent-Class-250-43.5R; US-Patent-Class-356-51) Avail: US Patent Office CSCL 07D

A nondispersive gas analyzing means includes the following:

(1) a variable volume container for receiving a quantity of a reference gas, (2) a second variable volume container for receiving a quantity of an unknown gas to be analyzed, (3) means for differentially varying the density of the gas in the first and second containers, (4) means for causing radiation to pass serially through the first and second containers, (5) a radiation detector for detecting the intensity of the radiation emerging from the second container and generating a radiation signal responsive thereof, and (6) electronic means for selecting and displaying a particular component of the radiation signal which is uniquely related to the amount of gas of the reference type present in the unknown gas. Official Gazette of the U.S. Patent Office

N72-31142 Notre Dame Univ., Ind. Radiation Chemistry Data Center.

SELECTED SPECIFIC RATES OF REACTIONS OF THE SOLVATED ELECTRON IN ALCOHOLS

Edgar Watson, Jr. and Sathyabhama Roy NSRDS Aug. 1972 22 p refs Sponsored jointly by NBS and AEC

(NSRDS-NBS-42; LC-72-600051; COO-38-784) Copyright. Avail: SOD $0.30 as C 13.48:42

Solvated electrons are generated in alcohols by radiolysis, photolysis, and reactions with sodium. Rates of reactions of solvated electrons with solvent and solute molecules, ions, and transients in alcohol solutions were compiled. Arrhenius parameters are tabulated for some reactions. Author

N72-31143*# Florida State Univ., Tallahassee. Dept. of Physics.

THE ABSORPTION OF METHANE AT LOW TEMPERATURE IN THE 0.84 MICRON REGION

R. H. Hunt, M. G. Faulkner, H. D. Downing, and R. G. Lee [1972] 8 p

(Grant NGR-10-004-056)

(NASA-CR-128023) Avail: NTIS HC $3.00 CSCL 07D

The absorption spectra of methane at low temperature with application to Jupiter atmospheric methane absorption is discussed. Experiments were made between 11,900 and 11950/cm. Attempts were made to observe single lines and determine the intensity of the spectra. E.H.W.

N72-31144*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHEMICAL RESEARCH PROJECTS OFFICE: FUNCTIONS, ACCOMPLISHMENTS, AND PROGRAMS

D. A. Kourtides and J. A. Parker Sep. 1972 15 p refs

(NASA-TM-X-62186) Avail: NTIS HC $3.00 CSCL 07D

The purpose, technical accomplishments, and related activities of the Chemical Research Project Group are outlined. Data cover efforts made to: (1) identify chemical research and technology required for solutions to problems of national urgency, synchronous with aeronautics and space effort; (2) conduct basic and applied interdisciplinary research on chemical problems in the areas of macromolecular science and fire research, and (3) provide productive liaison with the engineering community and effective transfer of technology to other agencies and industry. Author

N72-31145*# National Academy of Sciences-National Research Council, Washington, D.C.

AUTOMATED METHOD FOR STUDYING THE OXIDATIVE METABOLISM OF ANILINE AND SIMILAR COMPOUNDS

Patent Application

Robert L. Furner, inventor (to NASA) Filed 18 Aug. 1972 18 p Sponsored by NASA

(NASA-Case-ARC-10469-1; US-Patent-Appl-SN-281908) Avail: NTIS HC $3.00 CSCL 07D

An automated system for the study of drug metabolism is disclosed. The system monitors the oxidative metabolities of aromatic amines and of compounds which produce formaldehyde on oxidative dealkylation. It includes color-developing compositions suitable for detecting hydroxylated aromatic amines and formaldehyde. NASA

N72-31146# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

ANALYTICAL CHEMISTRY: KEY TO PROGRESS ON NATIONAL PROBLEMS

W. Wayne Meinke, ed. and John K. Taylor, ed. Aug. 1972 481 p refs Proc. of 24th Ann. Summer Symp. on Anal. Chem., Gaithersburg, Md., 16-18 Jun. 1971; sponsored by Anal. Chem., ACS Div. of Anal. Chem., and NBS Anal. Chem. Div.

(NBS-SP-351) Avail: SOD $3.50 as C13.10:351

Conference proceedings on research problems for which advanced analytical techniques may be used are summarized. The summaries cover the areas of agriculture, air pollution, clinical chemistry and biomedicine, oceanography, solid state research and electronics, and water pollution. For individual titles, see N72-31147 through N72-31153.

N72-31147 National Bureau of Standards, Washington, D.C.

THE CHEMICAL ANALYSIS OF THINGS AS THEY ARE

G. E. F. Lundell *In its* Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 1-15 Repr. from Ind. and Eng. Chem., v. 5, no. 4, 15 Jul. 1933 Presented at Div. of Phys. and Inorg. Chem. of 85th Meeting of Am. Chem. Soc., Washington, D. C., 26-31 Mar. 1933 (For availability see N72-31146 22-06)

The chemical analysis of materials and the problems encountered in analyzing such materials as they really exist in chemical state are discussed. Data cover: (1) the type of sample on which the analysis is made, (2) method of analysis that is used, (3) accuracy of the result, and (4) cost of the analysis. E.H.W.

N72-31148 Bell Telephone Labs., Inc., Murray Hill, N.J.

OPPORTUNITIES FOR ANALYTICAL CHEMISTRY IN SOLID STATE RESEARCH AND ELECTRONICS

Robert A. Laudise *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 19-73 refs (For availability see N72-31146 22-06)

Current practices and problems of analysis in solid state research and development are reviewed. Examples of solid state problems which were caused by inadequate appreciation and application of analysis are given. In particular, it is pointed out that trace analysis at and below the ppb level, the careful assessment and mapping of physical perfection by X-ray and related techniques, and the use of solid state physical measurements such as conductivity and magnetic resonance will become more important in the future. Mapping techniques and perfection techniques are reviewed, in some detail. Recent new methods of stoichiometry assessment are described, and it is suggested that the determination of perfection and defects should become an orderly subdiscipline under the aegis of analytical scientists. The case is made that, insofar as both research and technological progress in solid state and electronics are rate limited by the availability of materials with appropriate properties, it is limited in many cases in ability to characterize materials. It is concluded that with a modest reorientation of viewpoint and disciplinary content, analytical science could become the core discipline of materials characterization. Author

N72-31149 Hartford Hospital, Conn. Clinical Chemistry Lab.

ANALYTICAL PROBLEMS IN BIOMEDICAL RESEARCH AND CLINICAL CHEMISTRY

George N. Bowers, Jr. *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 75-157 refs (For availability see N72-31146 22-06)

The contributions of analytical chemistry to clinical medicine and solving some of the problems of national health care are outlined. Diagnostic aspects cover transaminase assays in heart attacks and calcium determinations in hyperparathyroidism. Also discussed is the relationship that exists between analytical chemistry and medicine, biomedical research, and enzymology. E. H. W.

N72-31150 Department of Agriculture, Washington, D.C.
ANALYTICAL PROBLEMS IN AGRICULTURAL SCIENCE
George W. Irving, Jr. and W. C. Schaefer *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 161-242 refs (For availability see N72-31146 22-06)

A review and analysis of the widespread applications of analytical chemistry and analytical instrumentation in the research and regulatory programs of the Agricultural Research Service of the Department of Agriculture are presented. Chemical analysis will be shown to play a vital role in assuring an adequate supply of farm and forest products and in assuring the consumer a better product while minimizing costs for processing and distribution. Along with the far-ranging applications of analytical chemistry in agriculture come many unsolved analytical problems. An assessment of these problems is made including an analysis of their relative importance in conjunction with the urgent needs of agriculture. Possible ways of classifying or categorizing these problems will be suggested. For example, amino acid analysis touches almost every branch of agricultural science whereas pesticide analysis is more restricted but has a great many more complexities. For any given pesticide, methodologies may be needed for controlling its application and for measuring its residues in free and bound form, its metabolites, trace contaminants, and the inert ingredients in its formulation. Other problems are discussed for which there appears no current solution. Author

N72-31151 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Chemistry and Physics.
ANALYTICAL PROBLEMS IN AIR POLLUTION CONTROL **c20**
A. P. Altshuller *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 245-293 refs (For availability see N72-31146 22-06)

The role of measuring techniques in activities ranging from research to regulatory activities of the Environmental Protection Agency are discussed. Field and laboratory instruments and manual techniques will receive consideration. Both point sampling and remote types of instrumentation developments will be reviewed. Chemical and physical transformations contribute to the formation of new or modified pollutant species. Air quality measurements must be capable of properly following such transformations. Special emphasis was given to the conversion of gases into various submicron particulate species. The mass, particle size distribution and details of chemical composition of these particles is required. Examples are given of new and improved types of air quality measurements, stationary source and mobile source emission measurements which may be needed to meet air quality and emission standards. Author

N72-31152 Michigan Univ., Ann Arbor. School of Public Health.
ANALYTICAL PROBLEMS IN WATER POLLUTION CONTROL **c13**
Khalil H. Mancy *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 297-390 refs (For availability see N72-31146 22-06)

The problems of controlling water pollution and the physical, chemical, and biochemical procedures used for that control are examined. Data cover organic residues, waste effluents, metal traces, and inorganic residues. Data are also presented on efforts made to establish parameters for determining water quality and the development of automated analytical measuring systems. The reliability of the measuring system is included. E.H.W.

N72-31153 Johns Hopkins Univ., Baltimore, Md.
PROBLEMS IN APPLICATIONS OF ANALYTICAL CHEMISTRY TO OCEANOGRAPHY **c13**
James H. Carpenter *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 391-430 refs (For availability see N72-31146 22-06)

The general character of oceanic and estuarine systems poses special problems in applying analytical chemistry to the description of these environments. The chemistry of sea water is described in general terms and the resulting analytical problems are identified by type examples. For the more abundant constituents, analytical precision and accuracy approaching the classical atomic weight measurements is required if improved data are to be obtained. For the moderately abundant constituents and, in particular, for those elements that participate in biological processes, large time and space variations occur and the requirement of large amounts of data favors automated analyses, if precision and accuracy can be retained. For the trace constituents including many of the heavy metals, inaccuracy produced by current techniques and analysts has produced a nearly useless body of data. Author

N72-31154# National Research Council of Canada, Ottawa (Ontario).
ADHESION OF POLYURETHANE COATINGS TO METAL AND GLASS
A. N. Kuksin 1972 12 p refs Transl. into ENGLISH from Sin. Fiz.-Khim. Polim., Akad. Nauk Ukr. SSR, Inst. Khim. Vysokomol. Soedin. (Kiev), no. 7, 1970 p 120-124
(NRC-TT-1576) Avail: NTIS HC $3.00

A study was made of the quasi-equilibrium adhesion of polyurethane coatings in relation to the nature of the substrate and the oligoether, the molecular weight of the latter, and the NCO/OH ratio. It was shown that the adhesion of coatings based on ODA-1200 was weaker than that of coatings based on a simple oligoether, a copolymer of tetrahydrofuran with propylene oxide (THF - 25% PO-1200). In the case of coatings based on ODA-1200, there is an extreme dependence of adhesion on the NCO/OH ratio. A decrease in the molecular weight of ODA results in better adhesion of coatings based on it. At the same time, the adhesion of coatings based on ODA-1200 and THF - 25% PO-1200 decreases with the following series: steel > brass > glass, while in the case of coatings based on ODA-600 the series is: steel > glass > Dural > brass. Author

N72-31155# National Research Council of Canada, Ottawa (Ontario).
VK-5 POLYURETHANE ADHESIVE WITH REDUCED TOXICITY
V. A. Kudishina and E. F. Morgunova 1972 12 p refs Transl. into ENGLISH from Sin. Fiz.-Khim. Polim., Akad. Nauk Ukr. SSR, Inst. Khim. Vysokomol. Soedin. (Kiev), no. 7, 1970 p 125-129
(NRC-TT-1577) Avail: NTIS HC $3.00

The development of a cold hardened polyurethane adhesive of the VK-5 type from DGU and polyether 24 is investigated. The chemical, mechanical, and physical properties of the resulting adhesive are given. Detailed results are given in tables. E.H.W.

N72-31156# National Research Council of Canada, Ottawa (Ontario).
DETERMINATION OF DENSITY OF LIQUIDS AND GASES TO AN ACCURACY OF 1/MILLIONTH g/cu cm WITH A SAMPLE VOLUME OF ONLY 0.6 cu cm
O. Kratky, H. Leopold, and H. Stabinger 1972 14 p refs Transl. into ENGLISH from Z. Angew. Phys. (West Berlin), v. 27, no. 4, 1969 p 273-277
(NRC-TT-1583) Avail: NTIS HC $3.00

After an introductory discussion of the problems of an extremely accurate density determination with liquids and gases, a method for density measurement is described. Its novel feature is that an exactly defined volume of the sample takes part in the undamped oscillation of a mechanical oscillator, thereby changing its natural frequency. Both the mechanical oscillator and the electronic setup are described. Precision density measurements were performed with solutions of human gamma globulin; DNS, viruses, cellulose nitrate, polymeta-bromo styrene, polyortho-bromo styrene, and pseudoisocyanine as well as Cu phthalocyanine. The partial specific volumes of the dissolved substances were calculated. As an example for the accuracy of the described method, the density of only 1 cu cm of a NaCl solution in water with exactly known concentration was measured

to 0.000001 g/cu cm. A perfect agreement with available values from standard tables was found. Author

N72-31157# National Research Council of Canada, Ottawa (Ontario).
CORRELATION BETWEEN COMPOSITION, PREPARATION AND PROPERTIES OF CROSS-LINKED POLYURETHANES. 16: POLYURETHANE COATINGS BASED ON ORGANOSILICON TRIHYDRIC ETHER ALCOHOLS AND POLYISOCYANATES WITH BIURET STRUCTURE
V. P. Kuznetsova and S. I. Omelchenko 1972 12 p refs Transl. into ENGLISH from Sintez i Fiz.-Khim. Polimerov, Akad. Nauk Ukr. SSR, Inst. Khim. Vysokomolekul. Soedin. Sb. Statei (Kiev), v. 7, 1970 p 115-119
(NRC-TT-1575) Avail: NTIS HC $3.00

The possibility of obtaining two-component polyurethane films based on triatomic organosilicon ether alcohols and polyisocyanate with a biuret structure was investigated. It was found that the films are well bonded to the substrates, are hydrophobic, resistant to alkalies, and possess superior impact and bending strengths. The differences in the structure of the initial ether alcohols effect the relative hardness, the thermomechanical properties, and the thermooxidative destruction of films. Author

N72-31158# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
INVESTIGATION OF THE EFFECTIVENESS OF A SIMPLE METHOD OF CHROMATOGRAM REDUCTION
V. F. Babkin, A. B. Kryukov, N. Ye. Rybyeva, Z. K. Fedotova, and Yu. M. Shtarkov 1972 26 p refs In RUSSIAN
Avail: NTIS HC $3.50

Algorithms used for the reduction of chromatographic spectra were adapted to the specific character of the signal. The algorithm was obtained by means of a small modification of the predictor of null order. Values of the reduction coefficient were obtained on the order of 2-3 times the comparison threshold values. The effect of the reduction algorithm on the accuracy of chromatogram conversion was evaluated, and the influence of channel errors is indicated quantitatively. Transl. by K.P.D.

N72-31159# RAND Corp., Santa Monica, Calif.
NINE CURRENT PROBLEMS IN THE THEORY OF ELECTROLYTE AND WATER BALANCE
E. C. DeLand Nov. 1971 15 p refs Submitted for publication
(P-4736) Avail: NTIS HC $3.00

The classical theory of fluid and electrolyte balance is reviewed. Current modeling practice is considered. The topics discussed include membrane processes, measurement and experiment design, the statistical design of experiments, kidney and muscle cell models, hormone control, stochastic processes and sensitivity analysis, and neural processes. K.P.D.

N72-31160# Technische Hogeschool, Delft (Netherlands).
MOLECULAR SIEVE ZEOLITES: PROPERTIES AND APPLICATIONS IN ORGANIC SYNTHESIS Ph.D. Thesis
Dirk Pieter Roelofsen 28 Jun. 1972 98 p refs
Avail: NTIS HC $7.00

The application of molecular sieve zeolites to shift chemical equilibria by the adsorptive removal of a reaction product is considered. Two batch techniques were used: the extraction technique and the suspension technique. In all reactions investigated, homogeneous or heterogeneous catalysis was applied to accelerate the reaction of A and B. The interaction of the homogeneous catalysts with the molecular sieves in the suspension technique was investigated, especially the exchange between protons of acid catalyst and cations of type A sieve. The construction of a simple adsorption apparatus, which enables a fast determination of the saturation capacities of molecular sieves for vapors, is described. It is shown that alkoxide-catalyzed ester interchange reactions proceed practically to completion when using type A molecular sieves to adsorb the displaced alcohol. Equilibrium constants were measured and rate studies made for several representative ester interchange reactions. Author

N72-31161*# North Dakota State Univ., Fargo. Dept. of Polymers and Coatings.
QUANTITATION OF BURIED CONTAMINATION BY USE OF SOLVENTS Semiannual Report, 1 Jan. - 31 Jun. 1972
S. Peter Pappas, Paul Hsiao, and Loren W. Hill 31 Jun. 1972 9 p ref
(Grant NGR-35-001-012)
(NASA-CR-128112) Avail: NTIS HC $3.00 CSCL 07D

Solubilization studies were carried out on various cured silicone resins. A solvent spectrum was prepared. It was found that complete dissolution of cured silicone resins could be achieved without extensive physical degradation of samples. Based on the solubilization results, amine solvents were selected for spore viability studies. Author

N72-31162# Technische Univ., Berlin (West Germany).
ADSORPTION EQUILIBRIA OF HELIUM, HYDROGEN AND NEON ON SOLID CARBON DIOXIDE Ph.D. Thesis [ADSORPTIONSGLEICHGEWICHTE VON HELIUM, WASSERSTOFF UND NEON AN FESTEM KOHLENDIOXID]
Wilfried Schulze 1971 72 p refs In GERMAN
Avail: NTIS HC $5.75

Adsorption equilibria for helium, hydrogen, and neon on carbon dioxide layers and the effects of carbon dioxide condensation conditions on the adsorption process are studied. The dependence of gas adsorption temperatures in effective deposition is described with isotherms obtained through the Dubinin-Radushkevich equation. It is shown that the adsorption behavior of the CO2 layer depends as well on the temperature as on the mass of the condensed CO2 and the condensation velocity. The inner surface layer increases up to temperatures of about 20 K, reaches a maximum of 368 sq m/g in the temperature region from 10 to 20 K, and decreases again at lower production temperatures. This effect is attributed to the formation of layers containing crystals of differing dimensions.
Transl. by G.G.

N72-31163# Technische Univ., Berlin (West Germany).
STUDIES OF RECOMBINATION AND REACTION PROCESSES AT THE GERMANIUM ELECTROLYTE CONTACT USING INTERNAL REFLECTION Ph.D. Thesis [UNTERSUCHUNG VON REKOMBINATIONS- UND REAKTIONSVORGAENGEN AM GERMANIUM-ELEKTROLYT-KONTAKT MIT HILFE DER INTERNEN REFLEXION]
Arnim DeHaan 1971 114 p refs In GERMAN
Avail: NTIS HC $7.75

Germanium/electrolyte contact properties are studied by superimposition of an alternating voltage on electrode potential and by registration of the alternating light component in the modulated absorption spectrum. This method observes only processes in the penetrated space charge zone of the semiconductor, directly on semiconductor surface, and in the GOUY-layer of the electrolyte. Measured internal reflection signals are composed of, absorption through free carriers, absorption through charge carriers that occupy or vacate surface states, and absorption through electrolyte molecules. The addition of impurity ions produces a complicated absorption spectrum that does not coincide with free charge carrier absorption.
Transl. by G.G.

N72-31164# Technische Univ., Berlin (West Germany).
ELECTROCHEMICAL BEHAVIOR OF NICKEL ELECTRODE DEPENDING ON pH-VALUE AND ADSORBED ANIONS Ph.D. Thesis [ELEKTROCHEMISCHES VERHALTEN DER NICKELELEKTRODE IN ABHAENGIGKEIT VOM pH-WERT UND VON ADSORBIERTEN ANIONEN]

Hans-Joachim Raetzer-Scheibe 1971 103 p refs In GERMAN
Avail: NTIS HC $7.25

Electron diffraction spectra of passive nickel electrode surface reactions in sulfuric acid and potassium hydroxide solutions are used to observe the effects of pH values and adsorped anions on electrode potential. Two capacity maxima in nickel electrode reaction with sulfuric acid solution are caused by the pH value effect on electrolyte adsorption velocity and on oxidation of the primarily formed NiO to NiO2. Small additions of halogenic ions to sulfuric acid electrolyte cause changes in current density and potential capacity curves through their differing adsorption mechanisms on nickel surface. Potassium hydroxide containing solutions passify the nickel electrode by forming nickel hydroxide; hydroxide oxidizes to nickel oxyhydroxide at higher potentials. These effects of halogenic ions on electrode capacity components are attributed to increasing surface activity of the single anion. Capacity-time curves for the two step ionic iodine adsorption process on nickel surface show that iodine ion penetration into the Helmholtz layer produces a brief capacity increase followed by subsequent formation of chemical surface bonds and thus drastic reduction of electrode capacity.
Transl. by G.G.

N72-31165# Technische Univ., Berlin (West Germany).
STUDIES ON THE EFFECTS OF ADSORBED ANIONS ON ANODIC NICKEL DECOMPOSITION USING RADIOACTIVE SULFUR 35 ISOTOPE Ph.D. Thesis [UNTERSUCHUNGEN UEBER DEN EINFLUSS ADSORBIERTER ANIONER AUF DIE ANODISCHE NICKELAUFLOESUNG UNTER VERWENDUNG DES RADIOISOTOPS SCHWEFEL-35]
Juergen Krupski 1971 98 p refs In GERMAN
Avail: NTIS HC $7.00

Electrochemical and tracer studies on nickel dissolution and neutralization processes in sulfuric acid solutions are reported. It is shown that current density curves in active anodic metal dissolution and adsorption concentration of sulfur ions on nickel surface are functions of the following parameters: pre-treatment of nickel sample, stirring of electrolyte, quality of nickel, velocity of potential change, polarization direction, sulfate ion concentration in electrolyte, and concurring adsorption of impurity anions.
Transl. by G.G.

N72-31166# Technische Univ., Berlin (West Germany).
THE ANGLE- AND VELOCITY-DISTRIBUTION OF PRODUCTS FROM THE ION-MOLECULE REACTIONS O2(PLUS) PLUS D2 EQUALS O2D(PLUS) PLUS D AND Kr(PLUS) PLUS D2 EQUALS KrD(PLUS) PLUS D Ph.D. Thesis [DIE WINKEL- UND GESCHWINDIGKEITSVERTEILUNG DER PRODUKTE AUS DEN IONEN-MOLEKUEL-REAKTIONEN O2(PLUS) PLUS D2 GLEICHT O2D(PLUS) PLUS D UND Kr(PLUS) PLUS D2 GLEICHT KrD(PLUS) PLUS D]
Gunther Bosse 1971 69 p refs In GERMAN
Avail: NTIS HC $5.50

Products of ion-molecule scattering reactions were studied for their energy and scattering angle distributions in atomic transfer reactions between O2(+) and D2, respectively HD, as well as between Kr(+) and D2 respectively HD. It was shown that the process O2(+) plus D2 yields O2D(+) plus D can be triggered by the 2Ilg ground state as well as through the first, relatively long excitation state 4Ilu of the O2(+) ion. Between 1.9 eV and 4.5 eV energy an intermediate complex O2D2(+) is formed whose existence is deduced from the observed isotropic distribution of its decomposition product O2D(+). Above 4.5 eV a transition of the impulse mechanism to a stripping process takes place so that the O2(+) ion only collides with one of the two atoms. The reaction Kr(+) plus D2 yields KrD(+) plus D also exhibits isotropic intensity distribution at energies from about 0.8 to 1.8 eV.
Transl. by G.G.

N72-31167# Technische Univ., Berlin (West Germany).
WAVE MECHANICAL EFFECTS IN SCATTERING OF PROTONS, He(PLUS)- AND H2(PLUS)-IONS ON RARE GASES Ph.D. Thesis [WELLENMECHANISCHE EFFEKTE BEI DER STREUUNG VON PROTONEN, He (PLUS)- UND H2(PLUS)-IONEN AN EDELGASEN]
Hans-Peter Weise 1971 85 p refs In GERMAN
Avail: NTIS HC $6.25

The beam crossing method is used to obtain differential elastic cross sections for the systems H(+)-Kr, H(+)-Xe, He(+)-He, He(+)-Kr, He(+)-Xe, H2(+)-Ar, and H2(+)-Kr at primary ion energies between 3 eV and 100 eV. Analyses of angle distributions produced potential depths, equilibria distances, and in some cases also the potential curve.
Transl. by G.G.

N72-31168# Technische Univ., Berlin (West Germany).
ADSORPTION EQUILIBRIA OF HYDROGEN ON CONDENSED METHANE, ETHANE, AND PROPANE Ph.D. Thesis [ADSORPTIONSGLEICHGEWICHTE VON WASSERSTOFF AN KONDENSIERTEM METHAN, AETHAN UND PROPAN]
Volker Toelle 1971 86 p refs In GERMAN
Avail: NTIS HC $6.50

Discussed are the possibilities of predicting sorption capacities for condensed layers of the systems H2/CH4, H2/C2H6, and H2/C3H8. Adsorption equilibria of hydrogen on methane-, ethane-, and propane-condensates are found by measuring adsorption isotherms at 10 to the minus eight power to 0.0001 Torr. Adsorption heat dependences for all three adsorbents indicate the energetic heterogeneity of the condensates; adsorption energy decreases during growing deposition established areas where the adsorption heat is almost independent. Methane exhibits one, ethane two, and propane three such regions. It is shown that a Dubinin-Radushkevich equation can be used to predict the sorption behavior of the layers from the measured adsorption isotherm for a condensate.
Transl. by G.G.

N72-31169# Hamburg Univ. (West Germany).
THE MOLECULAR TEMPERATURE OF ZEOLITHIC WATER AND BENZENE IN ZEOLITH LINDE 13X FOR THE 90 TO 300 K REGION Ph.D. Thesis [DIE MOLWAERME VON ZEOLITHISCHEM WASSER UND BENZOL IM ZEOLITH LINDE 13X IM BEREICH 90 BIS 300 K]
Wolf Dieter Basler 1971 73 p refs In GERMAN
Avail: NTIS HC $5.75

Nuclear magnetic resonance spectra of adsorbed water and benzene molecules in a zeolithic filter show line width decreases at temperature intervals of about 10 degrees. Apparent molecular heat measurements in filter pores indicate that these characteristics can be connected with phase transformations in the course of increasing molecular mobility.
Transl. by G.G.

N72-31170# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
SYNTHESIS AND PROPERTIES OF 2,4,6 - TRINITRO CHLOROBENZENE [DARSTELLUNG UND EIGENSCHAFTEN VON 2,4,6-TRINITROCHLORBENZOL]
R. Hansen 31 Dec. 1971 29 p refs In GERMAN
(ICT-9/71) Avail: NTIS HC $3.50

The synthesizing process of trinitro chlorobenzene (TNCB) was modified by: (1) altering the composition of the original products and improving their purity; (2) adapting the process for production in the kilogram range rather than the gram range; and (3) analyzing the impurities of the end product. Optimal conditions for the reaction are discussed. Hydrolysis sensitivity and behavior with aluminum powder are analyzed.
ESRO

N72-31171# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
REACTIONS OF SEMICARBAZIDE AND SEMICARBAZIDE HYDROCHLORIDE WITH HYDRAZINE [REAKTIONEN VON SEMICARBAZID UND SEMICARBAZIDHYDROCHLORID MIT HYDRAZIN]
W. Engel 16 Dec. 1971 35 p refs In GERMAN

(ICT-10/71) Avail: NTIS HC $3.75

The chemical reactions of semicarbazide and semicarbazide hydrochloride with hydrazine and hydrazine hydrate were investigated. Semicarbazide reacts with hydrazine in a proportion of 1:2,1:1 with formation of carbohydrazine, and in a 2:1 proportion with formation of aminourazol hydrazine salts. Semicarbazide hydrochloride in presence of an excess of hydrazine also gives carbohydrazid. In the case of excess of hydrocfiloride or equal molecular amount, several reactions occur at the same time. Carbohydrazine, carbohydrazid carboamid, aminourazol and their hydrazine and ammonium salts were separated. Cobalt and nickel are used as catalysts, but this catalytic reaction does not occur with hydrochloride. ESRO

N72-31172# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
SYNTHESIS OF POLYALLYL NITRATE (PAN) [SYNTHESE VON POLYALLYLNITRAT (PAN)]
K. M. Bucerius 31 Dec. 1971 21 p refs In GERMAN
(ICT-14/71) Avail: NTIS HC $3.25

The synthesis of polyallyl nitrate (PAN) is described and its possible use as a propellant with storage and ballistic reliability discussed. A 40 percent water solution of polyacrylacid methyl ester is the base product. A reduction with lithium-aluminum hydride gives polyallyl alcohol which is transformed into the end product by nitration. ESRO

N72-31173# Royal Aircraft Establishment, Farnborough (England).
THERMAL DEGRADATION OF PERFLUORO ALKYLENE-LINKED ORGANOSILOXANE POLYMERS
J. L. Cotter Feb. 1972 18 p refs
(RAE-TR-72018; BR-28452) Avail: NTIS HC $3.00

The thermal degradation of two perfluoro alkylene linked, organosiloxane polymers was studied by combined pyrolysis, gas chromatography, and mass spectrometry. The principal degradation products were, in each case, methyl trifluoro silane, dimethyl difluoro silane, phenyl difluoro methane, methane, benzene, and toluene. The tendency for these polymers to degrade, at elevated temperatures, by reactions involving transfer of fluorine from carbon to silicon is paralleled by the electron impact behavior of their perfluoro alkylene linked, silane precursors. Author (ESRO)

N72-31174# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
REMOVAL OF BAKED ON ALUMINIZED SILICONE PAINT, PHASE 1
Gabriel Pilla 1 Mar. 1972 11 p
(AD-742795; NADC-72048-VT) Avail: NTIS CSCL 11/11

A safe and practical procedure for the removal of baked-on aluminized silicone paint used for coating R1820 engines is described. Factors affecting the removability rate of this paint system, such as the metal surface finishes and heat-cycle conditions are also included. Author (GRA)

N72-31175# Dow Chemical Co., Midland, Mich.
THERMALLY STABLE FLUOROCARBONS Final Progress Report, 1 Dec. 1969 - 31 Nov. 1970
Richard W. Anderson and Hughie R. Frick Mar. 1971 41 p refs
(Contract N00019-70-C-0284)
(AD-743231) Avail: NTIS CSCL 07/3

The preparation of thermally stable fluoropolymers based on perfluorocyclobutane was investigated using three approaches, each based on the synthesis of a different type of fluorocarbon alkoxide monomer. Two of these alkoxides were prepared by the reaction of potassium fluoride with bis(fluorosulfonate) compounds. One alkoxide is extremely stable, whereas the other is formed only as a transient intermediate. Neither polymerized with perfluorocyclobutene. A prototype of the third type of monomer was prepared, but it too failed to react with perfluorocyclobutene. Results indicate that the reactivity of perfluorinated alkoxides is extremely sensitive to structure. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General, and 21 Navigation.

N72-31176*# Auburn Univ., Ala. Engineering Experiment Station.
TELEVISION BROADCAST SATELLITE SYSTEMS, VOLUME 1 Final Report
E. R. Graf [1972] 88 p refs
(Contract NAS8-24818)
(NASA-CR-123818) Avail: NTIS HC $6.50 CSCL 17B

Empirical expressions are derived to account for various components of the television satellite broadcast system. Computer programs are developed to determine the system weight in any general design. The factors of picture quality, propagation losses, and RF power requirements are discussed and determined.
Author

N72-31177*# Illinois Univ., Urbana. Antenna Lab.
CURRENT DISTRIBUTION ON A CYLINDRICAL ANTENNA WITH PARALLEL ORIENTATION IN A LOSSY MAGNETO-PLASMA
Charles A. Klein, Paul W. Klock, and Georges A. Deschamps Jul. 1972 106 p refs
(Grant NGR-14-005-009)
(NASA-CR-128114; SR-19; Rept-72-3; UILU-ENG-72-2546) Avail: NTIS HC $7.50 CSCL 17B

The current distribution and impedance of a thin cylindrical antenna with parallel orientation to the static magnetic field of a lossy magnetoplasma is calculated with the method of moments. The electric field produced by an infinitesimal current source is first derived. Results are presented for a wide range of plasma parameters. Reasonable answers are obtained for all cases except for the overdense hyperbolic case. A discussion of the numerical stability is included which not only applies to this problem but other applications of the method of moments.
Author

N72-31178# National Physical Lab., New Delhi (India). Radio Science Div.
ROCKET LAUNCH CONSIDERATIONS FOR CONDUCTING RADIO PROPAGATION EXPERIMENTS FOR THE STUDY OF IONOSPHERE NEAR THE EQUATOR
M. K. Avadhanulu and K. S. Zalpuri Jan. 1972 39 p refs
(RSD-72) Avail: NTIS HC $4.00

The limitations are considered which are imposed by range considerations up on the rocket to ground propagation experiment at the equatorial rocket ranges located at Thumba and SHAR, India. It is shown that for frequencies below 5 MHz, it is necessary to launch into the Q-T region, and for these frequencies, the width of the Q-T region (expressed in terms of launch azimuth) is sufficiently wide to ensure validity in the Q-T approximation to accommodate slight changes in the rocket trajectory plane during the flight. On the other hand, the Q-L condition can also be used, using higher frequencies for the study of the E and F regions during the daytime, without interfering with the range safety requirements. Author

N72-31179# Communications Research Centre, Ottawa (Ontario).
IONOSPHERIC SOUNDING AS AN AID TO HF COMMUNICATIONS
Doris H. Jelly Dec. 1971 13 p refs
(CRC-1225) Avail: NTIS HC $3.00

A review of sounding systems that could be used to improve HF communications is presented. Systems that are

outlined are the sophisticated CURTS, developed for the U.S. Defense communications systems; CHEC and Channelsonde which were designed to aid Canadian military operations; and the integrated system that was proposed as a solution to communications problems in the Canadian north. From a consideration of these systems, it is apparent that the technology exists for developing sounding systems for a wide variety of applications. Author

N72-31180# Academy of Sciences (USSR), Moscow.
AUTOMATA AND THE CONTROL OF COMMUNICATIONS NETWORKS
V. G. Lazarev, ed. et al 1971 216 p refs In RUSSIAN
Avail: NTIS HC $13.00

Questions of synthesis of discrete automata and control systems for communications networks are considered. Control apparatus for network switching junctions, methods of determining the basic relationships between the computer and the switching equipment, and computer structure are discussed. Questions of dynamic control and the construction of decentralized control apparatus are also presented. Transl. by K.P.D.

N72-31181# Academy of Sciences (USSR), Moscow.
TRANSMISSION OF DISCRETE REPORTS ON CHANNELS WITH GROUPED ERRORS
E. L. Blokh, ed. and V. A. Garmash, ed. 1972 148 p refs In RUSSIAN
Avail: NTIS HC $9.50

The accuracy of information transmission on channels with grouping errors is considered. Various methods of mathematically determining the source of error are discussed. The possibility of using codes to correct errors is evaluated and decoding difficulties are analyzed. The limiting potential of communications systems and their operating algorithms are investigated.
Transl. by K.P.D.

N72-31182# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
GUIDELINE FOR CONSTRUCTING RADIOSONDE, TESS 1-X [GUIA PARA LA CONSTRUCCION DELA RADIOSONDA TESS 1-X]
F. W. Molina 1971 23 p In SPANISH
(Rept-12) Avail: NTIS HC $3.25

The development of the radiosonde TESS 1-X is summarized. The data presented includes the mechanical and electrical details applicable to the construction and testing of the components. The principal components are transmitter, receiver, sequential equipment, and power source. F.O.S.

N72-31183# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
STUDY OF A RADIOTELEMETRIC SCANNING SYSTEM OPERATING IN THE 216 TO 260 MHz BAND FOR ROCKET USE IN GENERAL SONDES [ESTUDIO DE UN SISTEMA RADIOTELEMETRICO DE BUSQUEDA Y SEGUIMIENTO OPERANDO EN LA BANDA DE 216 A 260 MHz PARA SER EM PLEADO EN COHETES O GLOBOS SONDA]
R. M. Cajal 1971 17 p In SPANISH
Avail: NTIS HC $3.00

The circuits developed for the transmission of data from sounding rockets to the ground are presented. Schematics for transmission and frequency control circuits are included.
Transl. by F.O.S.

N72-31184*# Maryland Univ., College Park. Dept. of Electrical Engineering.
STUDY OF OPTIMUM METHODS OF OPTICAL COMMUNICATION Final Technical Report
Robert O. Harger 1972 20 p refs
(Grant NGR-21-002-237)
(NASA-CR-122455) Avail: NTIS HC $3.00 CSCL 17B

Optimum methods of optical communication accounting for the effects of the turbulent atmosphere and quantum mechanics, both by the semi-classical method and the full-fledged quantum theoretical model are described. A concerted effort to apply the techniques of communication theory to the novel problems of optical communication by a careful study of realistic models and their statistical descriptions, the finding of appropriate optimum structures and the calculation of their performance and, insofar as possible, comparing them to conventional and other suboptimal systems are discussed. In this unified way the bounds on performance and the structure of optimum communication systems for transmission of information, imaging, tracking, and estimation can be determined for optical channels. Author

N72-31185*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL METHOD AND FORTRAN PROGRAM FOR THE SOLUTION OF AN AXISYMMETRIC ELECTROSTATIC COLLECTOR DESIGN PROBLEM
Oliver W. Reese Washington Sep. 1972 68 p refs
(NASA-TN-D-6959; E-6872) Avail: NTIS HC $3.00 CSCL 09C

The numerical calculation is described of the steady-state flow of electrons in an axisymmetric, spherical, electrostatic collector for a range of boundary conditions. The trajectory equations of motion are solved alternately with Poisson's equation for the potential field until convergence is achieved. A direct (noniterative) numerical technique is used to obtain the solution to Poisson's equation. Space charge effects are included for initial current densities as large as 100 A/sq cm. Ways of dealing successfully with the difficulties associated with these high densities are discussed. A description of the mathematical model, a discussion of numerical techniques, results from two typical runs, and the FORTRAN computer program are included.
Author

N72-31186# Communications Research Centre, Ottawa (Ontario).
DATA RETRANSMISSION FROM REMOTE SENSORS USING A UHF COMMUNICATIONS SATELLITE
R. J. Campbell Jun. 1972 29 p refs
(CRC-TN-640) Avail: NTIS HC $3.50

A preliminary study of the factors affecting the feasibility of using a UHF communications satellite, designed for low capacity two-way voice communication, to relay data from remote sensor platforms to a central control station has been made. It has been found that one 50 kHz linear voice channel, using FDMA, can relay during an hour 256 bits of data from each of 400,000 interrogated remote sensor platforms at a bit error rate of 0.000001. Author

N72-31187# Atomic Energy of Canada Ltd., Chalk River (Ontario).
FRONTIER EVENTS IN ELECTRICAL, ELECTRONIC, AND RADIO ENGINEERING FROM PICOWATTS TO TERAWATTS IN THE LAST 40 AND THE NEXT 60 YEARS
W. Bennett Lewis Nov. 1971 20 p refs Lecture presented at Toronto, 19 May 1971
(AECL-4071) Avail: AEC Depository Libraries; Atomic Energy of Can. Ltd., Chalk River $0.50

Major advances are reported in: electronic switching and computers; extension to higher radio-frequencies and wide ranges in amplifiers and communications; information theory and the detection of signals in noise; development of radar and television; new levels of high power generation and transmission; and new illumination methods. Author

N72-31188# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A SEARCH PROCEDURE FOR PHASED ARRAY RADARS
H. Dannemann Jun. 1970 16 p refs Presented at the Intern. Symp. on Inform. Theory, Noordwijk, Neth., 15-19 Jun. 1970

(Rept-155) Avail: NTIS HC $3.00

A search procedure for phased array radars was investigated to locate targets in a certain zone as quickly as possible and with a minimum of transmission energy. A cyclic search procedure is proposed which is an improvement over the cell-by-cell method and which consists of two phases: a learning phase in which the radar learns where to search for the targets and a testing phase during which the cells are tested. Both phases should be integrated into the sequential test. The advantage of the cyclic search procedure is that strong targets are found very quickly, regardless of their location in space. A cost analysis shows the advantage of using cyclic search procedure over the systematic cell-by-cell method. ESRO

N72-31189# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

A DIGITAL PICTURE GENERATOR FOR GRAPHICAL COMPUTER INFORMATION DISPLAY ON STANDARD TV MONITORS [EIN DIGITALER BILDGENERATOR ZUR AUSGABE GRAPHISCHER RECHNERINFORMATION AUF STANDARD-FERNSEH-SICHTGERAETEN]

J. Wernicke Jan. 1972 19 p refs In GERMAN; ENGLISH summary

(Anthro-Mitt-1/72) Avail: NTIS HC $3.00; Forschungsinst. fuer Anthropotech. 6 DM

The layout and operation of a digital picture generator for displaying graphical computer information on standard TV monitors is described. Because of its parallel method of operation and the basic absence of random errors, the picture generator is suitable for displaying complex graphical content. The layout, using largely identical digital components, enables the application of common integrated circuits for manufacturing of the picture generator. Author (ESRO)

N72-31190# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

TIME SERIES AND GROWTH CURVES: PART 1: SURVEY OF TIME SERIES ANALYSIS [ZEITREIHEN UND WACHSTUMSKURVEN: TEIL 1: UEBERBLICK UEBER ZEITREIHENANALYSEN]

H. Petersen Aug. 1971 22 p refs In GERMAN

(FTZ-A-11-TBr-2-PT-1) Avail: NTIS HC $3.25

The possibilities are described for using time series analysis in prognosis and planning. Time series are the most important basis of information for all long term prognoses and planning. In view of the increasing importance of long term planning in telecommunication, it is necessary to develop methods for the transformation of past knowledge into prognostic information and to enter decisions into the computer. The components of time series analysis and mathematical prediction models are described. ESRO

N72-31191# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

THE NOISE OF INFRARED DETECTORS AND METHODS FOR DETERMINATION OF CHARACTERISTIC DETECTOR VARIABLES [DAS RAUSCHEN VON INFRAROTDETEKTOREN UND MESSMETHODEN ZUR BESTIMMUNG DER CHARAKTERISTISCHEN DETEKTOR-MESSGROESSEN]

J. Vobian Jan. 1971 83 p refs In GERMAN

(FTZ-A-14-TBr-3) Avail: NTIS HC $6.25

Measuring equipment for the noise voltage and the detection characteristics of infrared detectors is described, in view of their possible utilization in coherent submillimeter wave communication. The characteristic variables for straightforward reception with detectors in the far infrared are introduced and explained. Several noise sources influencing the detector's operation and limiting the range of applicability are investigated. Background noise is found to be the principal limit for the application of photodetectors. These are ideal only when internal noise is less than background noise. A set-up is described which enables the measurement of noise voltage and infrared detector characteristics, the calibration, and if necessary, the adjustment of the receivers. ESRO

N72-31192# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

TRANSMISSION OF BLACK-AND-WHITE TV PICTURES OVER COMMUNICATION CHANNELS WITH 1 MHz BANDWIDTH [DIE UEBERTRAGUNG VON SCHWARZ-WEISS-FERNSEHBILDERN UEBER NACHRICHTENWEGE MIT 1 MHz BANDBREITE]

M. Lange Aug. 1971 58 p refs In GERMAN; ENGLISH summary

(FTZ-A-44-TBr-30) Avail: NTIS HC $5.00

The possibilities for television transmission over a channel with 1 MHz bandwidth are discussed and applications to closed circuit TV are mentioned. Problems such as the effective bandwidth requirement for a given TV standard, pulse response of a signal channel of limited bandwidth, and picture quality and its grading are dealt with. For a given bandwidth of 1 MHz two solutions to the problems are presented as a laboratory simulation: (a) restricted bandwidth transmission of signals using the TV broadcasting standard (625 lines/50 Hz), and (b) transmission using a standard proposed for videophone use (267 lines/60 Hz). The screen photographs presented lead to the assumption that 1 MHz bandwidth TV transmissions supply sufficient information to be of practical use for a number of applications. ESRO

N72-31193# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

INVESTIGATION OF SUITABILITY OF EARTH BASED RADIO LINKS TO DATA TRANSMISSION BY ERROR FREQUENCY MEASUREMENTS [UNTERSUCHUNG DER EIGNUNG VON RICHTFUNK-GRUNDLEITUNGEN FUER DATENUEBERTRAGUNG DURCH FEHLERHAEUFIGKEITS-MESSUNGEN]

D. Martin Sep. 1971 23 p refs In GERMAN; ENGLISH summary

(FTZ-A-44-TBr-31) Avail: NTIS HC $3.25

The error rate of transmission of pseudoternary data over telephony radio relay systems was investigated. The results of several series of measurements, the power spectra, and transmitted signal power are discussed. From the results, it appears that even when utilizing the radio relay channel with 1.07 bits per Hz bandwidth an error rate of less than 10 to the minus 7th power can be obtained independently of the number of radio sections. ESRO

N72-31194# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

CONTRIBUTION TO THE QUESTION OF DIGITAL MULTIPLEX HIERARCHY [BEITRAG ZUR FRAGE DER DIGITALEN MULTIPLEX-HIERARCHIE]

U. Assmus, W. Bartel, and H. W. Wellhausen Sep. 1971 9 p refs In GERMAN; ENGLISH summary

(FTZ-A-44-TBr-32) Avail: NTIS HC $3.00

A digital multiplex hierarchy is proposed for clock synchronization based on the PCM primary multiplex system operating at a bit rate of 2.048 Mbit/s and with multiplex factors of 4. The positive-negative stuffing technique is used. This concept provides very simple and uniform frame structures at each stage of the hierarchy, allowing without difficulties the transition to the synchronous network and thus to PCM exchanges. The second-order multiplex system allows one or two picture telephone signals to be transmitted at 8.448 Mbit/s and the third-order multiplex system a color television signal at 34.304 Mbit/s. Additional line systems can be obtained which make the proposed hierarchy more flexible by synchronous bit-by-bit interleaving of two information rates in the same stage of the hierarchy. ESRO

N72-31195# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
A HOLLOW CABLE ANTENNA FEED FOR 12 GHz [EINE HOHLKABEL-ANTENNENZULEITUNG FUER 12 GHz]
H. Richter, H. Schmidt, and H. J. Favreau Nov. 1971 47 p refs In GERMAN; ENGLISH summary
(FTZ-A-333-TBr-14) Avail: NTIS HC $4.50

A circular waveguide antenna feed is described for a 12 GHz radio relay system. Owing to the low insertion loss of less than 2 db for the 60 m long antenna feed, the site where the transmitter is set up does not depend on the antenna site. The results obtained from experimental transmission justify also, from an economical viewpoint, the use of this power transmission equipment for the SHF range. Proposals are discussed for a further reduction of the insertion loss and for a bent pipe. ESRO

N72-31196# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
COMPARATIVE MATHEMATICAL STUDY OF SIGNAL-TO-NOISE RATIOS OF SEVERAL MODULATION METHODS IN DIGITAL TRANSMISSION [VERGLEICHENDE MATHEMATISCHE STUDIE DER STOERABSTAENDE VERSCHIEDENER MODULATIONSARTEN BEI DIGITAL-UEBERTRAGUNG]
E. Thinius May 1971 26 p refs In GERMAN
(FTZ-A-442-TBr-36) Avail: NTIS HC $3.50

Several modulation methods for the transmission of high speed digital data over a transmission channel with certain properties (AM, SSB, FM and 4 and 8 PM) are compared regarding signal to noise ratios and distortion. By computerized simulation, pulse series at the end of a telephone transmission are calculated and the resulting time distortion, as compared to a fixed frame and amplitude or phase distortion, are statistically evaluated. As a result the necessary signal to noise ratios for several threshold values of amplitude and phase are determined. A big difference in the different modulation methods is not found. Only for the 8-phase modulation the necessary S-N ratio is higher as a result of the lower threshold distance. ESRO

N72-31197# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
INTERMODULATION NOISE IN FM-FDM RADIO LINK ON RADIO SECTIONS WITH DIRECT SIGHT AS RESULT OF INTERFERENCE FADING [INTERMODULATIONSGERAEUSCHE IM FM-FDM-RICHTFUNK AUF FUNKFELDERN MIT DIREKTER SICHT ALS FOLGE VON INTERFERENZSCHWUND]
L. Fehlhaber Feb. 1971 44 p refs In GERMAN
(FTZ-A-455-TBr-29) Avail: NTIS HC $4.25

The intermodulation noise on direct sight sections in FM-FDM radio relay systems is calculated as a result of interference fading produced by two-path propagation. It is assumed that the group delay difference between both waves is very small, approximately 1 nanosec. but that the amplitude ratio of both waves is near to 1. It is shown that strong intermodulation noise only appears simultaneously with fading breaks of more than 20 db. A relationship exists between the maximum possible intermodulation noise and the fading depth, with which the statistical distribution of the overall noise can be calculated as the sum of thermal and intermodulation noise, when the transmission attenuation is known. Because of the coupling of intermodulation noise and fading, the fading dependent intermodulation noise can be reduced by switching diversity. This makes it possible to comply with CCIR conditions. ESRO

N72-31198# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
STATISTICAL DISTRIBUTION OF TRANSMISSION ATTENUATION OF LAND LINKS WITH DIRECT SIGHT AT FREQUENCIES BETWEEN 2 AND 7 GHz [DIE STATISTISCHE VERTEILUNG DER UEBERTRAGUNGSDAEMPFUNG AUF LANDSTRECKEN MIT DIREKTER SICHT BEI FREQUENZEN ZWISCHEN 2 UND 7 GHz]
L. Fehlhaber Apr. 1971 38 p refs In GERMAN; ENGLISH summary
(FTZ-A-455-TBr-30) Avail: NTIS HC $4.00

Statistical distributions of the basic transmission loss on line-of-sight paths in radio relay systems are derived from the model of two-path propagation. These distributions are necessary for calculating the noise. The phase difference and the amplitude ratio of the two waves are assumed to be statistically varying quantities. The distribution functions calculated agree well with measured data, and they show the Rayleigh-like behavior as it is known from experiments. They are influenced substantially by the ratio of fading time and total time. In middle-Europe this time share shows typical annual and diurnal variations. Space and frequency diversity should allow essential improvements of the system performance. ESRO

N72-31199# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
FLUCTUATIONS AT THE BASEBAND LEVEL IN FM-FDM RADIO LINKS ON RF FIELDS WITH DIRECT SIGHT AS A RESULT OF INTERFERENCE FADING [SCHWANKUNGEN DES BASISBANDPEGELS IM FM-FDM-RICHTFUNK AUF FUNKFELDERN MIT DIREKTER SICHT ALS FOLGE VON INTERFERENZSCHWUND]
L. Fehlhaber Jun. 1971 28 p refs In GERMAN; ENGLISH summary
(FTZ-A-455-TBr-31) Avail: NTIS HC $3.50

Phase interference fading as observed on line-of-sight paths causes level deviations in the base-band of high capacity radio relay systems. These deviations were calculated as a function of the fading rate from the two-path propagation model. They prove to be small up to fading depths of 20 db and with the bandwidths usually employed in radio-relay systems. With deeper fades they rise to values far above those that can be permitted. Switching diversity proves to be a good means of diminishing these level deviations because of their dependence on the fading rate. Author (ESRO)

N72-31200# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
INTERMODULATION NOISE IN FM-FDM RADIO LINK AS A RESULT OF REFLECTION AND SCATTERING BY MOUNTAINS, TREES, BUILDINGS, AND AEROPLANES [INTERMODULATIONSGERAEUSCHE IM FM-FDM-RICHTFUNK ALS FOLGE VON REFLEXION UND STREUUNG DURCH BERGE, BAEUME, GEBAEUDE UND FLUGZEUGE]
L. Fehlhaber Oct. 1971 35 p refs In GERMAN; ENGLISH summary
(FTZ-A-455-TBr-33) Avail: NTIS HC $3.75

Intermodulation noise was calculated for four systems (120, 960, 1800, and 2700 voice channels) as a function of the baseband frequency, echo attenuation, and time delay. The calculated noise is illustrated in a series of curves. In the critical range of time delays, between 20 nsec and 1 microsec, the 960 channel system was found to suffer most from intermodulation noise. With small time delays the intermodulation noise is largest in the upper channels; with rising time delay the noise becomes larger in the lower channels. The curves show that small and medium time delays give the maximum intermodulation noise. Author (ESRO)

N72-31201# European Space Research Inst., Frascati (Italy).
ENHANCED SCATTERING AND DECAY OF ELECTROMAGNETIC WAVES IN THE IONOSPHERE
Marino Bornatici and Folker Engelmann (CNEN, Frascati, Italy) 1972 16 p refs Submitted for publication
Avail: NTIS HC $3.00

An analysis is presented of the possibility of exciting, nonlinearly a Langmuir wave by electromagnetic waves generated in the ionosphere at 500 km altitude. It is shown theoretically that for the effect to occur in a transmitter of at least 100 kW power a frequency of about 8 MHz is required in situ. The

Langmuir waves generated travel typically in the same direction as the primary beam. Due to the high power necessary, such an experiment does not seem feasible in the near future.
Author (ESRO)

N72-31202# Army Electronics Command, Fort Monmouth, N.J.
AN EVALUATION OF FEC CODING TECHNIQUES FOR TROPOSCATTER DATA CHANNELS Research and Development Technical Report
Elis D. Hanson, Lee J. Mueller, and John E. Quigley Mar. 1972 64 p refs
(DA Proj. 1X6-63717-D-458)
(AD-740734; ECOM-3548) Avail: NTIS CSCL 09/4

Straight through (from user to user) digital communications systems of the future, such as TRI-TAC and the Defense Communication System (DCS), will require forward error corrective (FEC) coding for data and teletype (TTY) traffic to maintain acceptable output error rate performance under poor transmission conditions. Several coding techniques have been analyzed and proposed in the past (e.g., by MALLARD system study contractors) for future tactical systems. In the investigation reported on herein, the efficacy of those techniques under current consideration was tested through a computer simulation of the coding (decoding) techniques involved and the application of these techniques to actual toposcatter, bit-by-bit, error data collected previously and stored on magnetic tape. Author (GRA)

N72-31203# Naval Postgraduate School, Monterey, Calif.
AN APPLICATION OF DIGITAL FILTERS FOR RADAR CLUTTER REDUCTION M.S. Thesis
David Lee Cummings Mar. 1972 44 p refs
(AD-742917) Avail: NTIS CSCL 17/9

The thesis presents the design procedures involved in implementing a digital filter for use in a range-gated moving-target-indicator (MTI) radar. The digital MTI filter synthesized on the XDS-9300 computer was a third-order recursive filter with Chebyshev characteristics. The digital MTI filter was evaluated by constructing the equivalent of a single range channel for use with the AN/UPS-1 air-search radar and comparing its performance to that of the single delay-line canceler of the AN/UPS-1. Author (GRA)

N72-31204# Texas Univ., Austin. Applied Research Labs.
SONAR ARRAY STUDIES Final Report, 1 Dec. 1970 - 30 Nov. 1971
Jan M. Cooper, Louis H. Fowler, and Frederic G. Anderson 29 Mar. 1972 80 p refs
(Contract N00014-70-A-0166-0001; NR Proj. 240-014)
(AD-743199; ARL-TR-71-51) Avail: NTIS CSCL 17/1

The study was aimed at developing design guidelines for sonar projecting arrays to be used for high source level, wide sector applications. The effort began with a literature survey described in the first two sections: General Power Limits of Sonar Transducers, and Piezoelectric Properties of Ceramics. The piezoelectric equations of state are presented, along with a discussion of and results from two computer programs written to predict the performance of some different ceramics under various environmental and operational conditions. An analysis of beam patterns and directivity index of curved face arrays is presented.
Author (GRA)

N72-31205# Naval Electronics Lab. Center, San Diego, Calif.
A COMPARISON OF MEASURED AND CALCULATED VLF DIURNAL PHASE AND AMPLITUDE CHANGES Research Report, Oct. 1971 - Mar. 1972
W. D. Westfall and J. A. Ferguson 29 Mar. 1972 52 p refs
(XR0080101)
(AD-742802; NELC-TR-1821) Avail: NTIS CSCL 17/2

Experimental diurnal phase and amplitude changes at VLF are matched by theoretical calculations. Comparisons between experimental and theoretical values are made for frequencies between 12.2 kHz and 26.1 kHz over both long and short paths.
Author (GRA)

N72-31206# Research Analysis Corp., McLean, Va.
ARMY ELECTROMAGNETIC COMPATIBILITY PROGRAM: PROGRAM REVIEW AND EVALUATION OF ANALYSIS MODELS. VOLUME 1: MAIN REPORT
Thomas J. Lawson, Roger A. Burt, and James E. Russell Apr. 1972 64 p refs
(Contract DAHC19-69-C-0017; RAC Proj. 011.609)
(AD-742807; RAC-TP-448-Vol-1) Avail: NTIS CSCL 20/14

The Department of the Army Electromagnetic Compatibility Program (EMCP) prescribed in AR 11-13 is reviewed and compared with the Dept. of Defense EMCP prescribed in DOD Directive 3222.1. Differences in their definition of EMC and in their program structures are discussed. The Life Cycle Management Model (LCMM), used by the Army to manage land combat systems through concept formulation contract definition, development and production, and operations and disposal, is reviewed and related to the EMCP to show where, in the LCMM, EMC analysis is required. The results of a limited comparison of EMC models available to the Army are discussed. Author (GRA)

N72-31207# Research Analysis Corp., McLean, Va.
ARMY ELECTROMAGNETIC COMPATIBILITY PROGRAM: PROGRAM REVIEW AND EVALUATION OF ANALYSIS MODELS. VOLUME 2: APPENDIXES A - D Final Report
Roger A. Burt, Thomas J. Lawson, and James E. Russell Apr. 1972 67 p
(Contract DAHC19-69-C-0017; RAC Proj. 011.609)
(AD-742808; RAC-TP-448-Vol-2) Avail: NTIS CSCL 20/14

The report contains the appendices for the Army Electromagnetic Compatibility Program discussed in N72-31206.
GRA

N72-31208# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
IMPROVED COMPUTER ORGANIZATION Final Report
S. Goldman 1 May 1972 61 p refs
(Contract N00014-67-A-0378-0005)
(AD-743133) Avail: NTIS CSCL 09/4

The principal result of the project is the development of a general quantitative theory of organized systems and organized activities. The theory is based principally on communication theory and statistical thermodynamics. According to the theory, organization is the imposition of constraints in order to reduce uncertainty. Organization is measured quantitatively as negative entropy. The effects of ambiguity and noise and methods for reducing them are analyzed. A careful investigation is made of the maintenance of an organized activity by using negative entropy assimilated from the environment, and some of the conditions required for stability are found. It appears that such systems become unstable outside a certain threshold.
Author (GRA)

N72-31209# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMUM DETECTION OF M-ARY ORTHOGONAL SIGNALS IN ELF NOISE ENVIRONMENTS
James W. Modestino 17 Mar. 1972 21 p refs
(Contract F19628-70-C-0230; AF Proj. 1508A)
(AD-743004; ESD-TR-72-77; TR-494) Avail: NTIS CSCL 09/4

Explicit receiver structures for the optimum detection of M-ary orthogonal signals in impulsive noise environments typical of ELF are determined. The resulting optimum structures, while shown to bear some resemblance to that which would have been obtained in the presence of Gaussian noise alone, exhibit an interesting nonlinear behavior. The difficulties in the actual implementation of this receiver are discussed, and several definitely suboptimum yet computationally superior structures are suggested. The results are felt to be applicable to a much broader class of channels characterized by impulsive interference.
Author (GRA)

N72-31210# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESCRIPTION OF THE LINCOLN LABORATORY WIDE-BAND ELF NOISE RECORDING SYSTEMS

James R. Evans, Donald K. Willim, and J. Royce Brown 17 Mar. 1972 42 p refs
(Contract F19628-70-C-0230; AF Proj. 1508A)
(AD-743006; ESD-TR-72-83; TN-1972-19) Avail: NTIS CSCL 14/3

The report describes the systems used to record wideband (12 Hz - 300 Hz) extremely low frequency (ELF) electromagnetic noise in a number of geographic locations. The first section centers on the analog recording system employed in Florida. Simply stated, analog tapes were recorded and later converted to digital tapes for further processing. Section II describes the NAVCOM system which employed on site digital recording. The final section describes the calibration procedures used to relate the digitalized data to absolute electromagnetic field levels. A distinctive feature of both systems is the care taken to preserve the wide dynamic range of the ELF noise while reducing the amount of man-made interference recorded. Results of analyzing the recorded noise data to optimize communications system performance in this frequency band are described in companion reports. Author (GRA)

N72-31211# Naval Postgraduate School, Monterey, Calif.
THE ACTIVE COUPLING OF ELECTROMAGNETIC WAVES HAVING DIFFERING PHASE CONSTANTS M.S. Thesis
Albert Edward Whitehead Dec. 1971 49 p refs
(AD-742916) Avail: NTIS CSCL 20/14

The theory of active coupling of two waves with differing phase constants is examined. Experimental results supporting this theory are presented which include coupled power measurements and variations in coupling parameters as a function of the physical structure. It is pointed out that this investigation could be applied directly to filter design and provides background work for the design of a broadband coupler. Author (GRA)

N72-31212# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MONOPULSE RADAR
A. I. Leonov and K. I. Fomichev 21 Jan. 1972 427 p refs Transl. into ENGLISH of the book "Monoimpulsnaya Radiolokatsiya" Moscow, 1970 p 1-392
(AD-742696; FTD-MT-24-982-71) Avail: NTIS CSCL 17/9

The book deals with certain problems of monopulse radar. Analyzed are principles of design and basic functional elements of monopulse direction finding systems, problems of accuracy and resolution. Author (GRA)

N72-31213# Westinghouse Electric Corp., Annapolis, Md. Ocean Research and Engineering Center.
PHASE COMPARISON SONAR. PHASE 2: TEST RESULTS
Aug. 1971 104 p refs
(Contract N00600-70-C-0249)
(AD-743259; BA-865) Avail: NTIS CSCL 17/1

A phase comparison sonar was developed and tested aboard the PCH-1 Hydrofoil to determine the feasibility of detecting obstacles, floating on or slightly below the sea surface, in the path of the ship's foils. Provisions were incorporated in the sonar design so that a side looking sonar mode could be tested while the craft was operating foilborne at speeds up to 40 kn. The sonar transducers and receiver were calibrated prior to the foilborne tests so that the magnitude of the flow noise could be measured in the sonar receiver bandwidth which is centered at 152 kHz. Author (GRA)

N72-31214# Army Foreign Science and Technology Center, Charlottesville, Va.
MEASUREMENT OF ELECTROMAGNETIC FIELDS OF INFRASONIC FREQUENCIES WITH A SYNCHRONOUS CAPACITIVE ACCUMULATION OF CHARGES IN THE AIR
U. S. Valeev 27 Jan. 1972 13 p refs Transl. into ENGLISH from Avtometriya (USSR), no. 1, 1967 p 54-61
(AD-743021; FSTC-HT-23-1553-71) Avail: NTIS CSCL 20/14

A method is discussed for measuring an electromagnetic field along the electric component, which employs synchronous accumulation of charges on a capacitor, and allows the measurement and detection of weaker fields. Author (GRA)

N72-31215# Hoffman Electronics Corp., El Monte, Calif. Military Products Div.
BEACON SET, RADIO, AN/TRN-30 (XE-1) (V) Final Design and Development Technical Report
Donald J. Cole Ft. Monmouth, N. J. ECOM Dec. 1971 150 p refs
(Contract DAAB07-69-C-0320)
(AD-743229; HEC-71-C-04; ECOM-0320-F) Avail: NTIS CSCL 17/7

The engineering program for the development of the Radio Beacon Set, AN/TRN-30(XE-1)(V) is summarized with respect to technical accomplishments and specification requirements. A review of the design and development phase of the program is presented with discussions of the technical design evaluations. The testing performed during the equipment evaluation is summarized and indicates conformance with all applicable requirements. The program accomplishments in the areas of maintainability, human factors engineering, the training course and value engineering are reviewed and salient points are discussed. Author (GRA)

N72-31216# Stanford Research Inst., Menlo Park, Calif.
PERFORMANCE OF HARD LIMITING SPREAD SPECTRUM TRANSMISSION SYSTEMS Final Technical Report
Pravin C. Jain Apr. 1972 66 p refs
(Contract F30602-71-C-0338)
(AD-743198; SRI-1328; RADC-TR-72-52) Avail: NTIS CSCL 09/4

The detection of spread-spectrum multiple-access signals relayed through a hard-limiting repeater is of considerable practical interest in satellite communication. The study provides a method for analyzing accurately the detection of a hard-limited PSK signal buried in noise having non-Gaussian components, by using a correlation detector. The problem is of both theoretical and practical interest. The probability of error is shown to be directly calculable from the characteristic function of the receiver output, without the need of obtaining the probability density function, which generally requires a difficult inverse transformation of the characteristic function. This approach might be of some theoretical interest in solving related problems. Author (GRA)

N72-31217# Naval Training Device Center, Orlando, Fla.
ELECTRO-OPTICAL MULTICHANNEL SONAR RECORDER/REPRODUCER, PHASE 2 Interim Report, Feb. 1971 - Jan. 1972
John C. McKechnie 1 May 1972 60 p refs
(AD-743091; NAVTRADEVCEN-IH-205) Avail: NTIS CSCL 14/3

A study was conducted to establish the preliminary design of a low tape speed, highly durable, multichannel sonar-audio recorder/reproducer for U.S. Navy Sonarman training. Interim results by analysis and by laboratory experimentation on a partial model of the multichannel electro-optical recorder indicate thus far, that an operational model can be satisfactorily built. The unit records 16 audio channels on 1/4 inch wide photographic film. This is done by modulating light emitting diodes (LED's) with the signal to be recorded. Emitted light from the LEDs is guided onto the film by 0.003 to 0.010 inch diameter optical fiber light guides. Evidence from this study justifies a directed effort toward building a fully operational unit having 450 parallel channels, and a bandwidth of 10 Hz to 10 kHz. Author (GRA)

N72-31218# Naval Postgraduate School, Monterey, Calif.
A DOUBLE-SIDEBAND LIMITING RADIO-FREQUENCY SPEECH PROCESSOR FOR INCREASING THE INTELLIGIBILITY OF SPEECH SIGNALS OVER NOISY SINGLE SIDEBAND CHANNELS M.S. Thesis

Raymond Louis Belanger Sep. 1971 37 p refs
(AD-742932) Avail: NTIS CSCL 17/2

The intelligibility of speech transmitted over noisy Single-Sideband channels can be increased by improving the average-to-peak ratio of a speech waveform while generating as few distortion products as possible. Previous studies have shown the effect of various distortion products on intelligibility and have concluded that an SSB clipping processor is ideal, although somewhat expensive and complex. A Double-Sideband Limiting processor was constructed and evaluated against a commercially available SSB-Clipper. Experimental evidence is presented to show that the DSB-Limiting scheme performed as well as the SSB-Clipping processor when the corrupting noise was introduced at audio frequencies. Author (GRA)

N72-31219# Ohio State Univ., Columbus. Electroscience Lab.
AN ADAPTIVE ARRAY FOR INTERFERENCE REJECTION IN A CODED COMMUNICATION SYSTEM
K. L. Reinhard May 1972 87 p refs
(Contract F30602-69-C-0112)
(AD-743342; ESL-2738-6; RADC-TR-72-91) Avail: NTIS CSCL 09/4

An adaptive receiving array for rejecting interference in a coded communication system is described and computer simulations are presented which illustrate basic properties of the array processor. The array automatically forms a beam in the direction of a signal bearing the proper code modulation and forms nulls in the directions of signals bearing improper modulation. The communication signal present at the array input is assumed to be biphase (0-180 degrees) modulated by the modulo-2 sum of a periodically-repeating code and a data sequence. The code is assumed known at the receiving site and is the means by which array distinguishes between desired and undesired signals. Author (GRA)

N72-31220# Sage Action, Inc., Ithaca, N.Y.
THE RCS OF CONDUCTIVE, SPHERICAL SHELLS WITH SMALL THICKNESS TO SKIN DEPTH RATIO Technical Report, 1 Apr. 1970 - 31 May 1971
R. W. Hale, D. F. Brown, and D. E. Ordway Jun. 1971 28 p refs
(Contract N00014-69-C-0170; NR Proj. 215-042)
(AD-743188; SAI-RR-7102; TR-2) Avail: NTIS CSCL 17/9

An experimental study has been carried out to investigate the radar cross section of extremely thin, conductive, spherical shells. In particular, shell thicknesses are considered which are less than the electrical skin depth of the shell material. Attention is focused on the confirmation of an earlier theoretical analysis. The tests were conducted at first resonance with X-band radar, using coated plastic balls as simulated shells. These results verify completely the prediction that the cross section can be equivalent to the return of a solid, metal sphere. They also agree remarkably well with the analytical correlation and indicate the shell, for practical purposes, does not have to be nearly as ideal as assumed in the theory. Author (GRA)

N72-31221# General Motors Corp., Goleta, Calif. Delco Electronics Div.
REMOTE AUTOMATIC MULTIPURPOSE STATION
B. M. Buck and W. P. Brown Apr. 1972 6 p
(Contract N00014-71-C-0357; ARPA Order 1783; NR Proj. 307-340)
(AD-742838; TR-3) Avail: NTIS CSCL 17/2

A new solid state timer was developed and fabricated for the thermoelectric power supply system. A second field trip was made to Barrow and the timer was installed. It was set to cycle every four hours for four minutes. At this time, the carrier frequency was shifted from a temporary frequency of 6.544 MHz to its permanent assignment at 6.221 MHz. The system was placed on the air on the 29th of February and was monitored for one month from the AIDJEX site which was approximately 300 nautical miles from Barrow. Operation of the system was excellent with a maximum outage duration on the link of 1 1/2 days due to a polar cap absorption event. This was verified with a disruption of other HF communication between Barrow and the AIDJEX camp. Author (GRA)

N72-31222# Office of Telecommunications Policy, Washington, D.C.
PERMANENT ARRANGEMENTS FOR THE COMMERCIAL COMMUNICATION SATELLITE SYSTEM OF INTELSAT
Stephen E. Doyle Sep. 1971 49 p Presented at 14 Colloq. on the Law of Outer Space during the 22d Intern. Astronaut. Congr. of the IAF, Brussels, 25 Sep. 1971
(PB-209055; OTP-SP-5) Avail: NTIS HC $3.00 CSCL 17B

The basic provisions of the permanent arrangements for Intelsat in relation to the interim arrangements of 1964 are outlined. The 1964 arrangements, the history and organization of the plenipotentiary conference on definitive arrangements of the International Telecommunications Satellite Consortium, and highlights of the 1971 definitive arrangements are summarized. Annexes include papers relating to the plenary sessions. Author (GRA)

N72-31223# General Applied Science Labs., Inc., Westbury, N.Y.
FOUR GHz DIELECTRIC WAVEGUIDE COMMUNICATION LINE Final Report, Feb. - Nov. 1971
Manlio Abele and Hector Medecki Nov. 1971 59 p refs
(Contract DOT-FR-10030)
(PB-208474; GASL-TR-762; FRA-RT-72-29) Avail: NTIS HC $3.00 CSCL 09A

The report presents the study of a 4 GHz dielectric waveguide communication line. Section 2 of the report presents the conclusions and the recommendations for an operational system. Sections 3 and 4 present the details of the technical work. Author (GRA)

N72-31224# Avco Corp., Wilmington, Mass. Systems Div.
HFPN IMPLEMENTATION STUDY Final Technical Report
Donald F. Cleaves, Eldon H. Burkinshaw, and Warren E. Woolhiser Griffiss AFB, N. Y. RADC Apr. 1972 66 p
(Contract F30602-70-C-0195)
(AD-743202; RADC-TR-72-84) Avail: NTIS CSCL 17/2

The purpose of the investigations and hardware development described was to improve the reliability and performance of the coherent linear FM/CW synthesizers, delivered by AVCO under previous contracts, and based on a modification of the Hewlett-Packard direct digital synthesizer, and to demonstrate the feasibility of using a new type of phase-locked VCO synthesizer for generation of the linear FM/CW waveform. The latter synthesizer was also incorporated into breadboard-type hardware to comprise a single-antenna vertical-incidence ionosonde. Author (GRA)

N72-31225# Texas Instruments, Inc., Dallas.
VIDEO MAPPER CONCEPT STUDY Final Technical Report, 25 Jun. 1970 - 25 Jun. 1971
Marion Bruce ONeal Apr. 1972 390 p refs
(Contract F30602-70-C-0163; AF Proj. 5597)
(AD-744012; RADC-TR-72-102) Avail: NTIS CSCL 17/6

The objective of this study was to find and explore possible video mapper systems alternative to the current systems employing the flying spot scanner and more suited for integration in future surveillance and control systems. The study was intended to provide technical direction for future mapper development based upon the impact of future system configurations and rapidly changing memory and optical sensing technologies. Seven different digital systems were subjected to a detailed exploratory design - five systems for live time mapping and two for dead time mapping. Author (GRA)

N72-31967* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION SIGNAL POWER MEASUREMENT
R. Winkelstein *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul.

1972 p 18-24 ref (For availability see N72-31964 22-34)
CSCL 17B

N72-31971* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT ION BEAM NOISE EFFECTS
G. L. Anenberg *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 61-71 refs (For availability see N72-31964 22-34)
CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also. 19 Mathematics.

N72-31226* TRW Systems Group, Redondo Beach, Calif.
DIGITAL CONTROL AND INFORMATION SYSTEM Patent
Larry William Moede, inventor (to NASA) Issued 1 Aug. 1972 8 p Filed 31 Dec. 1969 Supersedes N70-35351 (08 - 19, p 3505) Sponsored by NASA
(NASA-Case-NPO-11016; US-Patent-3,681,581; US-Patent-Appl-SN-889584; US-Patent-Class-235-151.1; US-Patent-Class-235-92MT; US-Patent-Class-235-150.1; US-Patent-Class-340-347AD; US-Patent-Class-323-19) Avail: US Patent Office CSCL 09B

A digital control and information system is reported that uses a digital-to-analog converter to digitize an analog error signal provided by a system error detector. The digital error representation increments or decrements a data register once each system frame period. The output of the data register controls the duty cycle within each frame period of an actuator power gate. The control system may be commonly operated with a plurality of error detectors to provide a plurality of separate control loops. This is accomplished by time multiplexing the various error signals prior to the digitizing step and sampling the digitized output at times corresponding to the signal portion of interest. The sampled values update a plurality of data registers, one each associated with each control loop.
Official Gazette of the U.S. Patent Office

N72-31227*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
AUTOMATIC RECOGNITION OF VECTOR AND PARALLEL OPERATIONS IN A HIGHER LEVEL LANGUAGE
Paul B. Schneck [1971] 8 p refs
(NASA-TM-X-68608) Avail: NTIS HC $3.00 CSCL 09B

A compiler for recognizing statements of a FORTRAN program which are suited for fast execution on a parallel or pipeline machine such as Illiac-4, Star or ASC is described. The technique employs interval analysis to provide flow information to the vector/parallel recognizer. Where profitable the compiler changes scalar variables to subscripted variables. The output of the compiler is an extension to FORTRAN which shows parallel and vector operations explicitly. Author

N72-31228*# Intermetrics, Inc., Cambridge, Mass.
ADVANCED DATA MANAGEMENT SYSTEM ANALYSIS TECHNIQUES STUDY Final Report
30 Jul. 1972 470 p refs
(Contract NAS9-12119)
(NASA-CR-128513) Avail: NTIS HC $25.50 CSCL 09B

The state of the art of system analysis is reviewed, emphasizing data management. Analytic, hardware, and software techniques are described. J.A.M.

N72-31229*# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
COMPUTER ENHANCEMENT THROUGH INTERPRETIVE TECHNIQUES Final Report
Garth Foster, Henk A. E. Spaanenburg, and Werner E. Stumpf Jan. 1972 89 p refs
(Grant NGR-33-022-125)
(NASA-CR-122469) Avail: NTIS HC $6.50 CSCL 09B

The improvement in the usage of the digital computer through the use of the technique of interpretation rather than the compilation of higher ordered languages was investigated by studying the efficiency of coding and execution of programs written in FORTRAN, ALGOL, PL/I and COBOL. FORTRAN was selected as the high level language for examining programs which were compiled, and A Programming Language (APL) was chosen for the interpretive language. It is concluded that APL is competitive, not because it and the algorithms being executed are well written, but rather because the batch processing is less efficient than has been admitted. There is not a broad base of experience founded on trying different implementation strategies which have been targeted at open competition with traditional processing methods. F.O.S.

N72-31230# Armed Forces Radiobiology Research Inst., Bethesda, Md.
DIGITAL RECORDING OF EAST NONRECURRENT PHENOMENA IN PULSE RADIOLYSIS STUDIES
G. M. Meaburn and B. M. Isaacs Apr. 1972 14 p refs
(AD-742077; AFRRI-TN72-2) Avail: NTIS CSCL 14/3

A new system is described for digital recording of analog signals in the microsecond range. The equipment is built around a Biomation 610 transient recorder and takes advantage of the fast response of the instrument's analog to digital converter. The wide frequency range of the system (dc to 2.5 mHz) permits digital recording of a rapidly changing nonrecurrent signal with storage on punched paper tape as an intermediate step prior to further analysis. Some of the design features are discussed. The equipment is being used in pulse radiolysis studies to digitize photoelectric signals corresponding to the changing optical absorption properties of short-lived chemical species.
Author (GRA)

N72-31231# Illinois Univ., Urbana. Dept. of Computer Science.
COST EFFECTIVE PRIORITY ASSIGNMENT IN NETWORK COMPUTERS
Edward K. Bowdon and William J. Barr 28 Mar. 1972 26 p refs
(Grant NSF GJ-28289)
(PB-208665; Rept-509) Avail: NTIS HC $3.00 CSCL 09B

With the advent of network computers, a new area of computer systems analysis has evolved. Unfortunately, most of the work which has been done to date merely extends the previously existing theory of communications. While this work has been very fruitful and produced important results, our analysis is predicated on the assumption that a geographically distributed network computer is in reality, quite different from telephone networks and individual computing centers. In this paper, attention is focused on the probable goals of the networks and defining a measure of cost effectiveness. Then, using this measure, a priority assignment technique is developed for the individual centers that comprise the network. Finally, the measure of cost effectiveness is expanded to determine load leveling rules for the entire network. Author (GRA)

N72-31232# Boeing Co., Seattle, Wash.
STRUCTURE-MEDIUM INTERACTION PHENOMENOLOGY Final Report, 1 Apr. 1971 - 31 Jan. 1972
W. J. Walker and J. W. Vanderlinden 31 Jan. 1972 134 p refs
(Contract DASA01-71-C-0067; DNA Proj. NWER-XAXS)
(AD-742839; DNA-2841F) Avail: NTIS CSCL 16/1

The report describes the structure-medium interaction code SMIPH developed from the FEAT Code. The SMIPH code is a structure centered axisymmetric finite element code for the analysis of plane stress wave propagation in earth type materials including geostatic effects. The code was originally developed on

the IBM 360 and then converted to the CDC 6600 computer at the AFWL Kirtland AFB. The primary objective in developing this code has been to perform a GRABS (Giant Reusable Air Blast Simulator) pre-test prediction of the first structural test. In addition to this pretest prediction a posttest analysis of the GRABBS D-1 test was made to establish the credibility of the code results. In addition to these analyses a procedure has been developed to determine the initial geostatic material stress state. This procedure is described in Appendix B of this report and is a modified acceleration pulse integration method. Author (GRA)

N72-31233# Naval Ship Research and Development Center, Bethesda, Md.
THE BANDIT COMPUTER PROGRAM FOR THE REDUCTION OF MATRIX BANDWIDTH FOR NASTRAN
Gordon C. Everstine Mar. 1972 73 p
(AD-743056; NSRDC-3827) Avail: NTIS CSCL 09/2

The report describes a matrix bandwidth reduction preprocessor for use with the NASA structural analysis computer program, NASTRAN. Called BANDIT, the program is written in FORTRAN and uses the Cuthill-McKee strategy for resequencing grid points. Versions of the program for both CDC and other computers are presented. Author (GRA)

N72-31234# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SOFTWARE SIMULATION OF THE MINUTEMAN D17B COMPUTER M.S. Thesis
Bruce Chatterton Mar. 1972 158 p refs
(AD-742965; GE/EE/72-7) Avail: NTIS CSCL 09/2

A software program has been written which simulates the functions of the Minuteman D17B computer at the register transfer level. The simulation program is written in the FORTRAN Extended language to be used on the Intercom System (teletype) of a CDC 6600 computer system. The simulation program consists of a main program and eight subroutines. A programming language for the D17B simulation was formed which contains numbers and load codes, switches, and miscellaneous commands. Example programs run on the simulated computer have been included to show the types of output available. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-31235* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CIRCULARLY POLARIZED ANTENNA Patent
Lester C. VanAtta and Robert J. Mailloux, inventors (to NASA) Issued 25 Jul. 1972 10 p Filed 6 Oct. 1969 Supersedes N70-20738 (08 - 08, p 1419) Sponsored by NASA
(NASA-Case-ERC-10214; US-Patent-3,680,142; US-Patent-Appl-SN-863914; US-Patent-Class-343-770; US-Patent-Class-343-771; US-Patent-Class-343-786; US-Patent-Class-343-797; US-Patent-Class-343-853) Avail: US Patent Office CSCL 09E

A circularly polarized antenna is reported using a planar array of at least two perpendicular pairs of linearly polarized elements (slot antennas or dipoles). The distance D between a given pair of parallel elements is selected to provide in a plane perpendicular to the elements of the pair, a field pattern very similar to that in a plane parallel to the elements, where both principal planes pass through the center of the array and are perpendicular to the plane of the array. Elements of a given pair are excited in phase, and the two pairs are excited in phase quadrature, whereby circularly polarized radiation is produced over a very wide sector of space in each principal plane, and therefore in all planes passing through the axis of the array.
Official Gazette of the U.S. Patent Office

N72-31236*# Bell Aerospace Co., Buffalo, N.Y.
TELEOPERATOR TECHNOLOGY AND SYSTEM DEVELOPMENT. VOLUME 2: APPENDIX E Final Report
Apr. 1972 43 p
(Contract NAS8-27021)
(NASA-CR-123748; Rept-8586-950001-A-Vol-2-App-E) Avail: NTIS HC $4.25 CSCL 09E

Drawings are presented for equipment designed and fabricated to affect the integration of controllers, displays and manipulators with a remote maneuvering unit. Schematic diagrams of the master and level controllers are also included for reference. Author

N72-31237# Australian Post Office Research Labs., Melbourne.
AN IMPROVED LINEAR MODULATOR
H. Brueggemann Jun. 1972 12 p refs
(Rept-6706) Avail: NTIS HC $3.00

An amplitude modulator making use of a feedback technique to achieve a linear operation with respect to two imputs was developed and an implementation of the technique making use of the very predictable exponential characteristics of the bipolar transistor is described. Results which verify its excellent characteristics are given. Author

N72-31238*# Iota Engineering, Inc., Tucson, Ariz.
HIGH INTENSITY PORTABLE FLUORESCENT LIGHT
F. B. Kendall Sep. 1972 160 p
(Contract NAS8-24527)
(NASA-CR-61397) Avail: NTIS HC $10.00 CSCL 09E

Eight high intensity portable fluorescent lights were produced. Three prototype lights were also produced, two of which were subsequently updated to the physical and operational configuration of the qualification and flight units. Positioning of lamp apertures and reflectors in these lights is such that the light is concentrated and intensified in a specific pattern rather than widely diffused. Indium amalgam control of mercury vapor pressure in the lamp gives high output at lamp ambient temperatures up to 105 C. A small amount of amalgam applied to each electrode stem helps to obtain fast warm-up. Shrinking a Teflon sleeve on the tube and potting metal caps on each end of the lamp minimizes dispersion of mercury vapor and glass particles in the event of accidental lamp breakage. Operation at 20 kHz allows the lamps to consume more power than at low frequency, thus increasing their light output and raising their efficiency. When used to expose color photographic film, light from the lamps produces results approximately equal to sunlight. Author

N72-31239*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH CURRENT ELECTRICAL LEADS Patent Application
Warner B. Kaufman and Roland Breitwieser, inventors (to NASA) Filed 19 Jul. 1972 9 p
(NASA-Case-LEW-10950-1; US-Patent-Appl SN-273222) Avail: NTIS HC $3.00 CSCL 09E

An electrical lead is reported that has insulators imbedded in an inner conductor rod to form an annulus between the rod and a surrounding outer sheath. This annular space is filled with gas which conducts heat and prevents electrical leakage. NASA

N72-31240# Technische Univ., Berlin (West Germany). Fachbereich fuer Verfahrenstechnik.
A CONTRIBUTION TO ELECTROSTATIC MEASUREMENT ON EFFECTIVE VALUES OF ALTERNATING-CURRENT VOLTAGE WITH THE HELP OF SERVO-COMPENSATION Ph.D. Thesis [EIN BEITRAG ZUR ELEKTROSTATISCHEN MESSUNG DER EFFEKTIVWERTE VON WECHSELSPAN-

NUNGEN MIT HILFE SELBSTTAETIGER KOMPENSATION]
Subrata Dasgupta 1971 94 p refs In GERMAN
Avail: NTIS HC $6.75

Precision and error bounds of a vibrating membrane electrometer with high conversion gain for measuring alternating current potentials are considered. It is shown that error effects in the contact potential decrease with increasing amplitude of the measurement voltage, and that long time measurements exhibit a null point constant up to plus or minus 1 mV/day.
Transl. by G.G.

N72-31241# Technische Univ., Berlin (West Germany).
MODULATION-SPECTROSCOPIC STUDIES ON PASSIVE NICKEL ELECTRODES Ph.D. Thesis [MODULATIONS-SPEKTROSKOPISCHE UNTERSUCHUNGEN PASSIVER NICKELELEKTRODEN]
Wolfgang Paatsch 1971 101 p refs In GERMAN
Avail: NTIS HC $7.25

Electro-optical studies on passive nickel electrodes in aqueous electrolyte are made in order to observe changes of the stoichiometric oxide surface layer in relation to electrode potential. Changes in electrode reflection caused by modulation of electrode potential are used to determine the specific composition of the oxide layer with special consideration of the different oxidation steps, as well as to observe the effects of doping substances on electrochemical oxidation kinetics of the surface layer. Transl. by G.G.

N72-31242# Laboratoire Central de Recherches Thomson, Orsay (France).
DESIGN AND DEVELOPMENT OF A MICROSTRIP DELAY LINE ADAPTIVE STRUCTURE FOR TWO THIN FILM TRANSDUCERS Final Report [ETUDE ET REALISATION D'UNE STRUCTURE D'ADAPTION A LIGNES A RUBAN (MICROSTRIP) POUR DEUX TRANSDUCTEURS A COUCHE MINCE RAPPORT FINAL]
DeFranould [1971] 11 p In FRENCH
Avail: NTIS HC $3.00

A microstrip adaptive structure for use in two thin film transducers is described. The structure is used at the end of a line as an interface between an acoustic delay line and the transducers. The microstrip causes an insertion loss in the 1200 to 1800 MHz range not superior to 50 db. The technical characteristics of the device are presented. Author

N72-31243# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et de ses Applications Spatiales.
THEORETICAL AND EXPERIMENTAL RESEARCH IN VIEW OF CORRELATION OF PLANAR SILICON TRANSISTOR RELIABILITY WITH 1/F BACKGROUND NOISE Final Report [RECHERCHES EXPERIMENTALES ET THEORIQUES EN VUE DE LA CORRELATION ENTRE LA FIABILITE DE TRANSISTORS PLAN AU SILICIUM ET LEUR BRUIT DE FOND EN EXCES RAPPORT FINAL]
G. Blasquez and M. Arsalane Mar. 1972 169 p In FRENCH Sponsored by Centre Natl. d'Etudes des Telecommun.
(LAAS-Publ-886) Avail: NTIS HC $10.50

A correlation of the background noise of bipolar transistors to their reliability has been established in order to perfect quick and cheap selection methods. A reliability analysis was carried out to follow the evolution of external parameters characterizing the degradation of component parts of 10 p-n-p and 10 n-p-n silicon transistors. Volt-ampere characteristics and spectra of background noise analyses were determined to investigate surface properties of emitting and collecting zones. A mathematical model, IBIS, is described, which simulates the electrical behavior of bipolar transistors. ESRO

N72-31244# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
CONSIDERATIONS ON PROBLEMS RELATED TO COMMON AND SERIES MODES. CORRECT USE OF GUARDS [CONSIDERATIONS SUR LES PROBLEMES DE MESURES LIES AU MODE COMMUN ET AU MODE SERIE. UTILISATION CORRECTE DES ECRANS DE GARDE]
P. Chausson Mar. 1972 34 p refs In FRENCH
(LAAS-SL-72-I-05) Avail: NTIS HC $3.75

Rules which must be applied when connecting voltmeters, especially modern digital voltmeters and analog to digital converters, in order to obtain accurate measurement results are reviewed, error sources analyzed, and methods of error prevention discussed. A short description is presented of the basic operation of several types of voltmeters as seen from the external circuit.
ESRO

N72-31245# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
COMPARATIVE INVESTIGATION OF THE LEGIBILITY OF LIGHT EMITTING NUMERALS [VERGLEICHENDE UNTERSUCHUNG DER LESBARKEIT SELBSTLEUCHTENDER NUMERISCHER ANZEIGEN]
H. Radl-Koethe, E. Schubert, and I. Saupe Jul. 1971 107 p refs In GERMAN; ENGLISH summary
(FB-6) Avail: NTIS HC $7.50

A comparative investigation of nine different readout systems of light emitting numerals is presented. Parameters relevant to the legibility threshold are discussed and the technical problems of the quantification of these parameters are mentioned. Threshold performances vary considerably with respect to exposure times necessary for correct readings as well as with respect to kind and amount of misreadings occuring. Rank orders according to legibility results differ markedly from subjective rankings. Misreadings are analysed qualitatively, and an attempt is made to explain the results obtained by estimating the relative influence of all relevant parameters. Proposals concerning the improvement of the readout systems are given. Author (ESRO)

N72-31246# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
DIGITAL INTEGRATION OF FIELD STRENGTH MEASUREMENTS [DIGITALE INTEGRATION VON FELDSTAERKEMESSWERTEN]
A. Schneider Aug. 1971 20 p refs In GERMAN
(FTZ-A-12-TBr-1) Avail: NTIS HC $3.00

Principles, operation, and circuitry are described for a digital interpreter. The interpreter was developed for determining mean values of short wave radio field strength measurements over periods of up to half an hour. The equipment consists of two electronic counters, a BCD code to telex code converter, and two tapepunchers. A control unit and a switching clock program the correct functional operation. ESRO

N72-31247# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
INFORMATION STORAGE IN MNOS STRUCTURES [INFORMATIONSSPEICHERUNG IN MNOS-STRUKTUREN]
A. Moeller Apr. 1971 21 p refs In GERMAN
(FTZ-A-421-TBr-3) Avail: NTIS HC $3.25

The possibility of using metal-nitride-oxide-silicon (MNOS) structures for data storage is investigated. MNOS structures show a hysteresis of the capacitance as function of the applied voltage, as a result of charge storage on the nitride-oxide boundary layer. For the same reason, MNOS transistors show a hysteresis of the threshold voltage as function of the charging voltage. Therefore, they can be used as storage elements. As a result of their low threshold voltage they are compatible with bipolar transistors, and they have a non-destructive readout feature. The switching principle of an MNOS memory is explained. The manufacturing possibilities for MNOS structures are shown. MNOS capacitor structures were manufactured by application of silane pyrolysis in the presence of ammonia. The possibility of combining MNOS and silicon-on-sapphire is investigated. ESRO

N72-31248# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
NOISE AND GAIN MEASUREMENTS OF LOW NOISE AMPLIFIERS [RAUSCH- UND VERSTAERKUNGSMESSUNG AN RAUSCHARMEN VORVERSTAERKERN]
H. J. Heun and H. Raubal Feb. 1971 22 p refs In GERMAN
(FTZ-A-445-TBr-11) Avail: NTIS HC $3.25

Suitable methods for the determination of noise and amplification properties of low noise preamplifiers are considered with regard to practically attainable measuring accuracy. The following error sources which disturb the determination of the input noise temperature are discussed separately: the uncertainty of the bath temperature of the noise standards, the precision of the feed line attenuation and the Y factor under consideration of three frequently used combinations of noise standards. It is shown that the noise measurement in combination with liquid helium is the most precise for large and small values of the input noise temperature. In addition, a method is described for determining the system noise temperature by two Y measurements with unknown antenna noise temperature, and simultaneous determination of the input noise temperature. ESRO

N72-31249# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
PLANAR GUNN ELEMENTS WITH SCHOTTKY CONTROL ELECTRODE [PLANARE GUNN-ELEMENTE MIT SCHOTTKY-STEUERELEKTRODE]
K. Heime Sep. 1971 22 p refs In GERMAN
(FTZ-A-651-TBr-2) Avail: NTIS HC $3.25

The use of three-electrode gallium arsenide Gunn devices as pulse amplifiers and regenerators was investigated. Theoretical considerations show that for such a device a Schottky contact as a control electrode is advantageous when compared with ohmic and capacitive contacts as to sensitivity, pulse shape and input/output separation. Some of these components have been manufactured and tested. The elements were compared quantitatively and qualitatively. Amplifications of a factor of 5 were obtained for pulse rise times of 100 to 200 psec. ESRO

N72-31250# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
LADDERTRON OSCILLATOR FOR THE 50 GHz RANGE [LADDERTRON-OSZILLATOR FUER DEN 50-GHz-BEREICH]
L. Kaiser Jan. 1971 15 p refs In GERMAN
(FTZ-A-64-TBr-3) Avail: NTIS HC $3.00

Laboratory tests of a 50 GHz Laddertron oscillator, for possible application in radio relay and satellite communication systems, are reported. The available tube has direct modulation and produces approximately 5 W HF continuous power with a frequency stability of 0.0007. It was found to be of importance to adjust the resonator so that in switching on the tube, the oscillation started up reliably. The tube is shown to be in accordance with specifications. ESRO

N72-31251# Aerospace Corp., San Bernardino, Calif. Technology Div.
BEAM SHAPING POTENTIAL OF HIGH-GAIN ANTENNAS FOR GEOSTATIONARY COMMUNICATION SATELLITES WITH HIGH INTERFERENCE REJECTION
Klaus G. Schroeder 28 Feb. 1972 32 p refs
(Contract F04701-71-C-0172)
(AD-743292; TR-0172(S2141)-1; SAMSO-TR-72-125) Avail: NTIS CSCL 09/5

The treatise summarizes a preliminary study of antenna beam shaping potential and/or limitations, as applied to sharing of available frequency bands between satellite and terrestrial systems. Two different aspects are discussed: low energy levels outside a certain 'spot' region on the earth, and rapid decay at the boundary of the region. These are performance characteristics generally related to antenna configuration and design. Not discussed is the problem of over and under illumination of oddly shaped geographical areas. Author (GRA)

N72-31252# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
ADVANCED CONCEPTS OF MICROWAVE GENERATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1971
G. C. Dalman, L. F. Eastman, C. A. Lee, and J. Frey Griffiss AFB, N. Y. RADC Mar. 1972 132 p refs
(Contract F30602-71-C-0110; AF Proj. 5573)
(AD-743196; RADC-TR-72-45; QPR-5) Avail: NTIS CSCL 09/1

The report deals with the progress made during the fifth quarterly period of a solid state microwave oscillator and amplifier research and development program. Discussed is the progress on the Gunn effect and related research. The progress made on a program on microwave transit time devices is also described. The following specific topics are reviewed: optimum structures for high average power TRAPATT devices; GaAs Schottky barrier avalanche diodes; nonlinearities of IMPATT reflection amplifiers; integrated IMPATT oscillators; integrated TRAPATT oscillators; high-frequency high-efficiency avalanche oscillations; high frequency PTI microwave oscillators; pulsed PTI microwave oscillators; power combining circuit studies. Finally, the progress made on the studies of solid state materials for microwave devices is reported. The topics include: ion implantation and diffusion; vacuum epitaxial growth in silicon; and ionization rates in gallium arsenide. Author (GRA)

N72-31253# Boeing Co., Seattle, Wash. Aerospace Group.
TRANSISTOR NONLINEAR DAMAGE Final Report, Aug. 1971 - Mar. 1972
Louis L. Sivo 15 May 1972 168 p refs
(Contract N00014-72-C-0026)
(AD-743207) Avail: NTIS CSCL 09/1

The report summarizes the study of radiation induced surface degradation of (1) discrete planar transistors and (2) of devices in a silicon hybrid array (bipolar transistors, MOSFETS, MOS capacitors). The study of planar transistors, resulted in determining (1) the relative role of the charge accumulation and of the interface states in the surface degradation, (2) that no differences exist between the type of surface effects caused by proton and gamma irradiation and (3) the possibility of channeling a new mode of failure of the NPN transistor gain at very high doses. These effects were correlated with the studies of effects in hybrid array devices. Surface conditions as a function of dose were monitored primarily by gate controlled measurements on the bipolar transistors. Author (GRA)

N72-31254# Massachusetts Inst. of Tech., Cambridge.
DESIGN PROCEDURE FOR EQUIRIPPLE NONRECURSIVE DIGITAL FILTERS M.S. Thesis
Richard W. Hankins 12 May 1972 153 p refs
(Contract DAAB07-71-C-0300)
(AD-743109; TR-485) Avail: NTIS CSCL 09/5

A design procedure for the class of nonrecursive digital filters exhibiting equiripple passband and stopband characteristics is presented. With this method it is possible for a designer to obtain the coefficents necessary to realize a desired filter without having to implement the design algorithm on a general-purpose digital computer. This method also enables the designer to examine several alternative designs before deciding on a particular solution. In particular, using a recently proposed algorithm, the author has generated designs for more than 500 filters and systematically catalogued them in both tabular and graphical form. Author (GRA)

N72-31255# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Progress Report, 16 Sep. - 16 Dec. 1971
Lester A. Jeffries Apr. 1972 25 p
(Contract DAAB07-70-C-0110; DA Proj. 1H6-62705-A-055)
(AD-743218; Nort-70-353-7; ECOM-0110-7; QPR-7) Avail: NTIS CSCL 09/1

The report describes the progress which occurred during the

seventh quarter of a Research and Development contract to develop a 32 x 52 resolution-element, digital address, thin display tube for use in a man-pack radar application. During this quarter two DIGISPLAY tubes were assembled, processed, and tipped off. Work on two addition tubes was initiated. Design of a miniaturized display electronics unit was completed, and fabrication of a mockup of this unit was finished. Author (GRA)

N72-31256# Harry Diamond Labs., Washington, D.C.
THE USE OF FIBER OPTICS FOR OSCILLOSCOPE EXTERNAL TRIGGERING
Rudolph J. Prochazka Apr. 1972 14 p
(AD-742677; HDL-TM-72-5) Avail: NTIS CSCL 14/2

The input to the external trigger circuit of an oscilloscope is normally designed to accept a remotely generated trigger signal via coaxial cable. A photodiode was installed in the input so that it accepts an optical trigger signal via a fiber optic cable. This inexpensive conversion is useful in electromagnetic interference (EMI) studies, where hard wire cable can contaminate shielded environments, and does not interfere with the oscilloscope's other triggering capabilities. The original input can be restored at any time, in the field or in the laboratory. Author (GRA)

N72-31257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF COMPUTER STUDIES OF REVERSIBLE POINT INTEGRATOR CIRCUITS
V. M. Bondarenko and G. Y. Beretovenko 9 Feb. 1972 9 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR (Kiev), v. 32, no. 1, 1971 p 45-49
(AD-742681; FTD-HC-23-1850-71) Avail: NTIS CSCL 09/2

It is shown that synthesis of reversible point integrators poses the problem of creating special dc amplifiers operating at large output voltage levels. The feasibility of such amplifiers can only be determined through calculations, but this becomes very difficult for multipoint integrators due to the large number of circuit nodes where voltages must be determined. The AV-102 universal ALGOL computer program is used to alleviate some of these computational difficulties. The program is used to design a 17 point second order integrator. Author (GRA)

N72-31258# Martin Marietta Corp., Orlando, Fla.
MULTILAYER PRINTED WIRING BOARD DESIGN STANDARD Final Report, 2 Oct. - 5 Dec. 1970
Walter S. Rigling Aug. 1971 32 p refs
(Contract DAAB07-70-C-0096)
(AD-741353; OR-11035; ECOM-0096-F) Avail: NTIS CSCL 09/5

The data obtained from the literature survey, verification testing, and industry coordination meetings was reviewed and summarized into a series of design recommendations. The final draft of the design standard and the final redraft of MIL-P-55640 was completed. Author (GRA)

N72-31259# International Rectifier Corp., El Segundo, Calif. Semiconductor Div.
POWER DIODE AND SILICON CONTROLLED RECTIFIER TEST CONSOLE NO. 52-1003 Final Report
Frank Durnya and L. M. Noyes May 1972 40 p refs
(Contract DAAK02-70-C-0350)
(AD-742698) Avail: NTIS CSCL 14/2

The object of the program was to design, develop, fabricate and deliver a high performance, self-contained thyristor tester with capability of modular add-ons for future equipment requirements so as to sustain a full test capability for complete characterization of high speed, high current and voltage thyristors. The equipment was designed and built to enable testing from a centralized test station by a semi-skilled operator without prior experience in power testing. Author (GRA)

N72-31260# California Univ., Berkeley. Electronics Research Lab.
HORIZONTAL DIPOLE ARRAYS OVER LOSSY GROUND
W. C. Kuo and K. K. Mei Dec. 1971 108 p refs
(Contract DAAK02-71-C-0206)
(AD-743249; ERL-71-4) Avail: NTIS CSCL 09/5

The Approximate Boundary Condition is introduced and applied to find the Hertz potential for a horizontal dipole over a lossy ground. The integrals so obtained can be computed much more economically than the Sommerfeld's integral. The results of this approximation are compared with those of Sommerfeld's formulas. It is found that the accuracy is very good in most of the cases even where both the dipole and observation positions are very close to the air-earth interface. The Hertz potential thus obtained is then applied to find the current distribution for a horizontal antenna over a lossy ground. The resulting integral equation is then reduced to Hallen's type, and the current distribution is obtained by a numerical technique. The current distribution for a parallel array antenna fed by the transmission line is also obtained by coupling the transmission line equations to Hallen's equation. Author (GRA)

N72-31261# Michigan Univ., Ann Arbor. Physics Lab.
NOISE GENERATING MECHANISMS IN AVALANCHE TRANSIT TIME AND TRANSFERRED ELECTRON OSCILLATORS AND AMPLIFIERS Interim Report, 1 Jul. 1971. 1971 - 1 Jan. 1972
Walter R. Curtice Fort Monmouth, N. J. ECOM Apr. 1972 100 p refs
(Contract DAAB07-71-C-0244; DA Proj. 1S6-62705-A-056)
(AD-743227; ECOM-0244-1; Rept-010348-1) Avail: NTIS CSCL 09/1

A model for the AM and FM noise in an avalanche transit-time (ATT) diode oscillator is developed. From the model, the AM and FM noise spectra are computed for a series of operating points. Three circuit models, optimum, parallel resonant RLC and a coaxial cavity tuned by slugs, are considered so that noise inherent to the diode can be separated from circuit effects. Results of these computations are described. Three types of waveguide resonant circuits fabricated for use with X-band (i.e., 8.2 GHz to 12.4 GHz) transferred-electron devices are described. Author (GRA)

N72-31262# Radio Corp. of America, Lancaster, Pa. Industrial Tube Div.
THIRTY KILOWATT HEAT PIPE DEVELOPMENT Final Technical Report, 15 Apr. 1970 - 30 Jun. 1971
30 Jun. 1971 82 p refs
(Contract DAAB07-70-C-0217)
(AD-742495) Avail: NTIS CSCL 09/1

A program was conducted for the development, fabrication and test of a heat pipe radiator for cooling a 30 kilowatt microwave klystron. A design concept was generated which employs twelve heat pipes in radial array to extract heat from the klystron collector. Detailed calculations were performed for the design of the individual heat pipes and the heat pipe to air heat exchanger. A one sixth size model was constructed and tested to evaluate the engineering design. Author (GRA)

N72-31263# Northwestern Univ., Evanston, Ill. Information Processing and Control Systems Lab.
REAL-TIME INFORMATION PROCESSING SYSTEMS RESEARCH Final Report, 1 Apr. 1971 - 31 Mar. 1972
G. J. Murphy, M. Epstein, and B. W. Jordan May 1972 7 p
(Contract N00014-67-A-0356-0023; NR Proj. 373-502)
(AD-742853) Avail: NTIS CSCL 09/3

The final report on research conducted at Northwestern University under Contract Number N00014-67-A-0356-0023 covers the period from 1 April, 1971 through March 31, 1972. The work conducted under this contract was in the areas of thin-film devices and computer graphics. The results achieved are summarized in this report. Author (GRA)

N72-31264# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF SINGLE CRYSTALS OF TUNGSTEN AS HIGH TEMPERATURE HEATERS OF LONG CATHODES
E. M. Savitskii, G. S. Burkhanov, V. I. Petrachenkov, I. V. Timokhov, and N. N. Raskatov 8 Feb. 1972 15 p refs Transl. into ENGLISH from the publ. "Monokristally Tugoplavikikh i Redkikh Metallov" Moscow, Nauka, 1969 p 172-179
(AF Proj. 7351)
(AD-742813; FTD-MT-24-1586-71) Avail: NTIS CSCL 09/1

The first results of testing of single crystals of tungsten as a material for heaters of long cathodes in powerful electric vacuum devices showed that during the operation of the heaters under conditions of thermal cyclings their brittle rupture occurs. It has been established that cyclic temperature load gives rise to thermal fatigue of the heaters made from single crystals of tungsten however, prolonged vacuum annealing makes it possible to delay the onset of thermal fatigue of the heaters and to ensure the necessary life of a cathode even under vibration and shock loads. Author (GRA)

N72-31265# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
RAPID DESIGN PROCEDURES FOR THE BRUNE AND BOTT-DUFFIN CIRCUITS Physical Sciences Research Papers
Kurt H. Haase 6 Mar. 1972 28 p ref
(AF Proj. 5628)
(AD-744059; AFCRL-72-0172; AFCRL-PSRP-481) Avail: NTIS CSCL 09/5

Assuming that a driving-point impedance F (s) = N (s)/D (s) is known by the coefficients of the rational function, both polynomials of the same degree and normalized, the A-type (resistance series) and/or the B-type (resistance parallel) Brune circuit can rapidly and with high accuracy be designed, using the evaluation results of N (j omega) and D (j omega) only. In a few steps the circuit can be transformed in the Bott-Duffin circuit. The suggested procedures are advantageous when F (s) is a function of high rank. A particular example is presented by which, using analog data processing, a rather complicated network can rapidly be designed. Author (GRA)

N72-31266# Naval Research Lab., Washington, D.C. Electromagnetic Propagation Branch.
ANTENNA PARAMETERS OF THE US NAVY VLF TRANSMITTING STATION, NWC, HAROLD E. HOLT AT EXMOUTH, AUSTRALIA Final Report
John W. Brogden and John E. Raudenbush May 1972 26 p
(NRL Proj. 54R07-22)
(AD-743884; NRL-MR-2440) Avail: NTIS CSCL 09/5

An investigation was conducted during October and November 1971 to determine the parameters of the antenna system at the U.S. Navy VLF transmitting station (call letters NWC) at the Naval Communications Station, Harold E. Holt, Exmouth, Australia. The results showed that there has been no noticeable deterioration of the antenna system since the Proof of Performance tests were made in 1967. Author (GRA)

N72-31267# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Final Report, 15 Feb. 1970 - 15 Feb. 1972
W. F. Goede, ed. and Lester A. Jeffries, ed. May 1972 114 p
(Contract DAAB07-70-C-0110; DA Proj. 1H6-62705-A-055)
(AD-743220; NORT-70-353-8; ECOM-0110-8) Avail: NTIS CSCL 09/1

The report describes the work carried out during a two-year research and development contract to develop a feasibility-model 32 x 52 resolution-element thin-display tube (the DIGISPLAY) for a man-pack radar. The design and fabrication of an initial bell-jar DIGISPLAY is described in detail. The measured performance of this first display was good. It operated at a brightness of 100 foot-Lamberts, a minimum contrast-ratio of 10:1, and required a total input-power of 3 watts, including electronics. Only one of its 1664 resolution elements was defective. A second display was developed for packaging in a thin glass envelope. It was designed using a flatter area-cathode and thinner switching plates than the ones used in the bell-jar display. Several flat display-tubes were fabricated and tested. Author (GRA)

N72-31268# Varian Associates, Palo Alto, Calif. Tube Div.
TRANSMITTER TUBE FOR TROPOSCATTER APPLICATION Triannual Report no. 4, 24 Aug. - 24 Dec. 1971
Arthur Goldfinger Apr. 1972 44 p
(Contract DAAB07-70-C-0228; DA Proj. 1H6-62705-A-055)
(AD-743226; ECOM-0228-4) Avail: NTIS CSCL 09/1

The program is directed toward further development and testing of the klystron amplifier. The prime purpose of that effort was to establish the design criteria for a high gain, high power amplifier operating in the 4.4 to 5.0 GHz range. The present program will extend the initial effort with the aim of improving and further productizing that design. During this report period, an extensive testing program was completed, the results of which are published here. Various cooling configurations are being studied to determine the most efficient and practical method of cooling the klystron and magnet. Design work on the simplified (one knob) tuning mechanism is in progress. Ninety percent of all parts for two developmental klystron amplifier tubes have been ordered. Author (GRA)

N72-31269# Energy Sciences, Inc., Burlington, Mass.
DIELECTRICS STUDY Final Report
Gordon K. Simcox Jun. 1972 35 p refs
(Contract DASA01-71-C-0029)
(AD-743170; DNA-2823F) Avail: NTIS CSCL 09/1

The dielectrics study was concerned with evaluating pulse signature effect upon the dielectric strength of deionized water. The double resonance HV generator used provided a prestressing of the dielectric before the major stress and the influence of this prestress was of interest. The report describes the transformer generator and its characteristic in some detail and deals also with the overall experimental arrangements. Author (GRA)

N72-31270# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OUTPUT OF A MULTIPLIER GIVEN TWO NOISY INPUTS
Walter A. Johnson 15 May 1972 17 p
(Contract F04701-71-C-0172)
(AD-742979; TR-0172(2230-20)-14; SAMSO-TR-72-92) Avail: NTIS CSCL 09/5

The output of a multiplier is determined for two noisy inputs of the form V sub i1(t) = K sub 1 sin omega sub 0 + n sub 1(t) and V sub i2(t) = K sub 2 sin omega sub 0 (t + T sub 0) + n sub 2(t) where n sub 1(t) and n sub 2(t) are band-pass, stationary, white-noise processes of zero mean that have Gaussian amplitude distributions. The output signal-to-noise ratio is calculated for a low-pass output. Author (GRA)

N72-31271# Owens-Illinois, Inc., Toledo, Ohio. Electro-Optical Display Development Dept.
THREE COLOR PLASMA PANEL DISPLAY DEVICE Quarterly Report, 1 Oct. - 31 Dec. 1971
H. J. Hoehn, R. A. Martel, W. D. Petty, R. W. Burke, and J. Schermerhorn May 1972 32 p
(Contract DAAB07-70-C-0243)
(AD-742718; ECOM-0243-6; QR-6) Avail: NTIS CSCL 09/5

The objectives of the program are to design, fabricate, and evaluate a plasma-panel display device having three-color capability and to investigate and develop a technique for operating such a device with at least three levels of intensity. A 33 line-per-inch 3-color panel was operated dynamically over the full 128 x 128 lines. An attempt was made to operate a 60 line-per-inch 3-color panel dynamically. A method of heat-treating photomasters of the phosphor-pattern to reduce dimensional

differences between the masters and the electrodes has been evaluated. Depositing phosphors by spray-coating was evaluated and compared to the flow-coating and hand-dusting techniques.
Author (GRA)

N72-31272# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Quarterly Progress Report, 1 Dec. 1971 - 1 Mar. 1972
G. I. Haddad May 1972 72 p refs
(Contract F30602-71-C-0099)
(AD-744015; RADC-TR-72-99; QPR-6) Avail: NTIS CSCL 09/1

Objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification and control. Current tasks under the program are: High-power Gunn-effect devices; Gunn-effect amplifiers; Modulation properties of Gunn-effect devices; Avalanche-diode amplifiers; High-efficiency avalanche diodes; Nonlinear operating characteristics of IMPATT diodes; Solid-state device fabrication; Instabilities in germanium. GRA

N72-31642 Joint Publications Research Service, Arlington, Va.
DYNAMIC BALANCING OF ROTORS
V. Ye. Myachin *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 11-17 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 4, 1967 p 100-104 (For availability see N72-31639 22-21)

N72-31968* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE RESPONSE OF A 0.03-cm SILICON DETECTOR TO A MIXED NEUTRON AND GAMMA FIELD AS A FUNCTION OF SHIELD MATERIAL AND THICKNESS
M. Taherzadeh *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 25-41 refs (For availability see N72-31964 22-34)
CSCL 09E

N72-31969* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LARGE SPACECRAFT ANTENNAS: CONICAL RING-MEMBRANE REFLECTORS
R. E. Oliver, M. R. Trubert, and A. H. Wilson *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 42-47 refs (For availability see N72-31964 22-34)
CSCL 17B

N72-31057 AEG-Telefunken, Hamburg (West Germany).
STANDARDIZED DESIGN AND TECHNOLOGY OF BLACK BOXES FOR POWER CONDITIONING ELECTRONICS
W. Koenneke *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 131-134 (For availability see N72-31043 22-03)

N72-31061 Fabrica Italiana Apparecchi Radio S.p.A., Milan (Italy).
POWER GENERATING SYSTEM FOR TRAVELING WAVE TUBES [DISPOSITIF D'ALIMENTATION POUR TOP]
L. Giardino *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 165-171 In FRENCH (For availability see N72-31043 22-03)

N72-31062 Selenia S.p.A., Rome (Italy). Div. Attivita Spaziali.
CIRCUITS FOR DELAYED SWITCHING AND LIMITATION OF TRANSIENTS IN THE POWER TRANSISTORS [CIRCUITS POUR LA COMMUTATION DIFFEREE ET LA LIMITATION DES TRANSITOIRES DANS LES ONDULEURS DE PUISSANCE]
S. Roccucci and G. Meneghini *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 173-181 In FRENCH (For availability see N72-31043 22-03)

N72-31063 Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et de ses Applications Spatiales.
ESTABLISHMENT OF A MODEL FOR SMALL SIGNAL BEHAVIOR OF CUTOUT POWER REGULATORS [ETABLISSEMENT D'UN MODELE POUR LE COMPORTEMENT A PETITS SIGNAUX DE CERTAINS REGULATEURS A DECOUPAGE]
R. Prajoux *In* ESRO Spacecraft Power Conditioning Electron. Jul. 1972 p 183-189 refs In FRENCH (For availability see N72-31043 22-03)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see 09 Electronic Equipment. For related information see specific Physics categories.

N72-31273* Singer-General Precision, Inc., Binghamton, N.Y.
CRT BLANKING AND BRIGHTNESS CONTROL CIRCUIT Patent
Robert L. Peters and Kenneth F. Koch, inventors (to NASA) Issued 18 Jul. 1972 6 p Filed 12 Nov. 1968 Sponsored by NASA
(NASA-Case-KSC-10647-1; US-Patent-3,678,191;
US-Patent-Appl-SN-774691; US-Patent-Class-178-7.5E;
US-Patent-Class-315-22R; US-Patent-Class-315-30R;
US-Patent-Class-330-27R) Avail: US Patent Office CSCL 09C

A cathode ray tube blanking and brightness control circuit is reported which employs an amplifier stage responsive to a square wave input signal and having an output connected to the cathode, a wave shaping circuit connected to the load impedance of the amplifier stage, and a level control circuit connected to the output of the amplifier stage. The wave shaping circuit is responsive to the trailing edge of the input signal for discharging the stray capacitance associated with the load impedance to effect a fast rise time of the signal at the output of the amplifier stage. The level control circuit is operable to vary the amplitude of the amplifier stage output which is applied to the cathode of the cathode ray tube. Official Gazette of the U.S. Patent Office

N72-31274*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
CONTROL OF LINEAR UNCERTAIN SYSTEMS UTILIZING MISMATCHED STATE OBSERVERS
Bernard Goldstein Jul. 1972 77 p refs
(Grant NGL-07-002-002)
(NASA-CR-128067; TR-72-5) Avail: NTIS HC $6.00 CSCL 09C

The control of linear continuous dynamical systems is investigated as a problem of limited state feedback control. The equations which describe the structure of an observer are developed constrained to time-invarient systems. The optimal control problem is formulated, accounting for the uncertainty in the design parameters. Expressions for bounds on closed loop stability are also developed. The results indicate that very little uncertainty may be tolerated before divergence occurs in the recursive computation algorithms, and the derived stability bound yields extremely conservative estimates of regions of allowable parameter variations. F.O.S.

N72-31275*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RELIABILITY OF HYBRID MICROCIRCUIT DISCRETE COMPONENTS
Robert V. Allen and Salvadore V. Caruso Aug. 1972 33 p
(NASA-TM-X-64686) Avail: NTIS HC $3.75 CSCL 09C

Data accumulated during 4 years of research and evaluation of ceramic chip capacitors, ceramic carrier mounted active devices, beam-lead transistors, and chip resistors are presented.

Life and temperature coefficient test data, and optical and scanning electron microscope photographs of device failures are presented and the failure modes are described. Particular interest is given to discrete component qualification; power burn-in, and procedures for testing and screening discrete components. Burn-in requirements and test data will be given in support of 100 percent burn-in policy on all NASA flight programs. Author

N72-31276# Energiya Publishing House, Moscow (USSR).
THE DYNAMICS OF CONTROL SYSTEMS USING MANIPULATORS
V. S. Kuleshov and N. A. Lakota 1971 304 p refs In RUSSIAN
Avail: NTIS HC $17.25

The principles of constructing remote-control manipulators are considered, as well as their control systems. A kinematic and dynamic analysis of the organs of manipulation as regulatory objects are presented, and the specifics of operating a control system by manipulators are discussed. The construction principles and research methods of reversible follow-up systems are presented for a class of two-dimensional systems of automatic control. Transl. by K.P.D.

N72-31277# Energiya Publishing House, Moscow (USSR).
TRANSFORMERS OF THE SIGNAL ENERGY TYPE IN AUTOMATIC CONTROL SYSTEMS
V. M. Eygenbrot 1970 272 p refs In RUSSIAN
Avail: NTIS HC $15.75

The construction and principles of sizing transformers of the electro-hydro-pneumo-signal energy type in automatic control systems are considered. Recommendations are given for the selection of transformer type, depending on the purpose and conditions of exploitation. The requirements and the means of realizing them are discussed for transformers operating in control systems, using digital computers. Transl. by K.P.D.

N72-31278# Naukova Dumka, Kiev (USSR).
MAGNET TECHNOLOGY, AUTOMATIC CONTROL, AND CYBERNETICS: PRINCIPLES OF CONSTRUCTING LOGIC AND PROBLEM-SOLVING SYSTEMS. A HANDBOOK
P. S. Yeremeyev and V. S. Podlipenskiy 1970 408 p refs In RUSSIAN
Avail: NTIS HC $22.50

Physical processes and phenomena in magnetic cores are briefly described, the operating principles of non-contact elements are considered, and means of realizing arithmetic and logic operations are discussed. The topics reviewed also include the synthesis of digital and analog control, decision making, conversion, and modeling apparatus - magnetic analog and analog-digital logic devices. Transl. by K.P.D.

N72-31279*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
OPTIMAL BRAKING STUDIES Final Summary Report, 1 Feb. - 15 Aug. 1972
John S. Pazdera 15 Aug. 1972 50 p refs
(Contract NAS8-28230)
(NASA-CR-123817) Avail: NTIS HC $4.50 CSCL 13I

To brake in minimum distance, the tire slip must be controlled to ride the peak of the mu-slip curve so that maximum ground force is developed between tire and pavement. The resulting control system differs from antiskid systems which react to impending wheel lockup. A simplified model is presented to permit development of a sound control strategy. Liapunov techniques are used to derive a peak riding adaptive controller applicable to each wheel of a breaking vehicle. The controller is applied to a more sophisticated model of a braking airplane with strut bending dynamics included. Simulation results verify the peak riding property of the controller and the rapid adaption of the controller to extreme runway conditions. The effect of actuator dynamics, perturbation frequency, type and location of sensors, absence of a free wheel, and a method in which the pilot's braking commands can be interfaced with the peak riding system are also considered. Author

N72-31280# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
CONSTRUCTION OF CONTROLLABLE FILTERS FOR SPEECH SYNTHESIS [AUFBAU VON STEUERBAREN FILTERN FUER DIE SPRACHSYNTHESE]
G. Vieweger Apr. 1971 26 p refs In GERMAN
(FTZ-A-416-TBr-3) Avail: NTIS HC $3.50

Three simple filters for a speech synthesis method are described. The filters, designed for simulation of the three formants of vocal consonants, have been realized as parallel resonant circuits, whose resonant frequency and quality can be continuously varied within certain ranges. Gyrators were used for the construction of the resonant circuits, and these permit a simulation of inductances by capacitors and a variation of the resonant frequency by regulation of the gyration ratio. The gyrators were designed with operational amplifiers. ESRO

N72-31281# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
ANALYSIS AND GROUP DELAY COMPENSATION OF SECOND A ORDER ALL-PASS WITH RESONANT CIRCUITS OF DIFFERENT QUALITIES [ANALYSE UND GRUPPENLAUFZEITKOMPENSATION EINES ALLPASSES 2. ORDNUNG, DESSEN SCHWINGKREISE UNTERSCHIEDLICHE GUETEN AUFWEISEN]
E. Rasch and H. Raubal Aug. 1971 37 p refs In GERMAN; ENGLISH summary
(FTZ-A-451-TBr-4) Avail: NTIS HC $4.00

A method is proposed which would compensate for group delay distortion of a second order allpass filter by different qualities of the resonant circuits. The theory of allpass filters assumes equal qualities of the circuits and describes the attenuation distortion and the compensation of the attenuation. The additional investigation of the group delay distortion caused by finite qualities of the resonant circuits assumed to be equal, is presented. The group delay response of an allpass filter and the characteristics of the eigenvalues in the complex p-plane are described for differing qualities. A means of compensating for the group delay distortion is proposed based on the selection of different qualities of the resonant circuits, i.e. different quality coils. This compensation is found to be good even in first approximation, if the product of the mean quality of the resonant circuits and the step-up factor of the allpass filter is large. ESRO

N72-31282# Texas Univ., Austin. Electronics Research Center.
DIFFERENCE OPERATOR ANALYSIS AND SYNTHESIS OF SWITCHING NETWORKS
William R. Adrion and Charles H. Roth 1 Sep. 1971 175 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-743285; AFOSR-72-0291TR; TR-111) Avail: NTIS CSCL 09/5

In earlier work, the differential mode (DM) model for sequential networks, in which the state of a sequential machine is given as a function of input and state changes, was introduced and applied to the analysis and synthesis of sequential switching networks. The report further develops the DM model and introduces new synthesis procedures for networks with edge-sensitive flip-flops. Author (GRA)

N72-31283# Arinc Research Corp., Annapolis, Md.
RELIABILITY PREDICTION FOR MONOLITHIC INTEGRATED CIRCUITS Final Report
J. Reese Nov. 1971 31 p refs
(Contract N00039-70-C-3537)
(AD-742847; Rept-947-01-1-1143) Avail: NTIS CSCL 09/5

The report presents the results of a study directed toward developing a reliability-prediction technique for monolithic integrated circuits. A prediction model that expresses reliability

as a function of device screening, sampling, system burn-in test, and field operate time was developed. The equation is based on data taken from military, space, and commercial application of integrated circuits. The report presents the rationale that led to formation of the equation and describes its use and methods of application. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-31284 Department of Energy, Mines and Resources, Ottawa (Ontario). Working Group on Satellite and Ground Station Engineering.
SATELLITE AND GROUND STATION ENGINEERING Resource Satellites and Remote Airborne Sensing for Canada Report No. 9
Dennis White, ed. 1971 44 p
(MS75-2/9) Copyright. Avail: Issuing Activity

A number of potential Canadian sites for an Earth Resources Technology Satellite (ERTS) ground station are evaluated, and the costs of developing a ground station at the different locations are estimated. The gain of the 84-foot dish antenna at Price Albert was measured, and found adequate for the ERTS mission so that only the feed and tracking system need be replaced. A survey of possible ground stations for ERTS E and F was made and it is recommended that the site of the NASA STADAN station at St. John's Newfoundland, be reactivated for these satellites. A brief survey of Canadian expertise that might be relevant to the development of a Canadian resource satellite is presented. Author

N72-31285# Interdepartmental Committee on Resource Satellites and Remote Airborne Sensing, Ottawa (Ontario).
ORGANIZATION FOR A NATIONAL PROGRAM ON REMOTE SENSING OF THE SURFACE ENVIRONMENT (A WORKING PAPER)
L. W. Morley 16 Oct. 1970 57 p
Avail: NTIS HC $5.00

A Remote Sensing Center is proposed within the federal government to provide technical and management coordination of a national remote sensing program. The center would be responsible for long range planning, for definition and coordination of requirements, and for undertaking projects in support of approved program plans. It would be expected to acquire and develop expertise in the principal areas of remote sensing activity, including data collection, processing, and interpretation, and would initiate and carry out research in these areas. The proposed Remote Sensing Center would be organized in five principal elements which carry out the functions of planning (Program Planning Office), data collection (Data Acquisition Division), data processing and distribution (Data Processing Division), and data interpretation research (Data Interpretation Division). Co-location of these organizational elements is recommended to facilitate communications and maximize efficiency in use of facilities, equipment and personnel. The proposed organization permits growth, as new requirements are introduced, without major re-structuring. Author

N72-31286*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE STEADY-STATE FLOW QUALITY IN A MODEL OF A NON-RETURN WIND TUNNEL
Kenneth W. Mort, William T. Eckert, and Mark W. Kelly Aug. 1972 28 p refs Prepared in cooperation with US Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62170) Avail: NTIS HC $3.50 CSCL 14B

The structural cost of non-return wind tunnels is significantly less than that of the more conventional closed-circuit wind tunnels. However, because of the effects of external winds, the flow quality of non-return wind tunnels is an area of concern at the low test speeds required for V/STOL testing. The flow quality required at these low speeds is discussed and alternatives to the traditional manner of specifying the flow quality requirements in terms of dynamic pressure and angularity are suggested. The development of a non-return wind tunnel configuration which has good flow quality at low as well as at high test speeds is described. Author

N72-31287# Committee on the Judiciary (U. S. House).
NEW JERSEY-NEW YORK AIRPORT COMMISSION COMPACT
Washington GPO 1972 618 p refs Hearings before Comm. on the Judiciary on H.J. Res. 1305 and related bills, 91st Congr., 19, 25 Nov. 1970 and on H.J. Res. 375, H.J. Res. 404, and H.J. Res. 433, 92d Congr., 14-15 Oct. 1971 and 24 Feb. 1972
Avail: Comm. on the Judiciary.

The hearings are reported concerning the compact to authorize the Waterfront and Airport Commission of New York and New Jersey to exercise regulatory powers at airports in New York and New Jersey. The articles of the bill are included along with reports from interested governmental agencies such as the Transportation and Commerce Department. F.O.S.

N72-31288*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MASK AND PATTERN CHARACTERISTICS
Donald E. Routh Aug. 1972 14 p
(NASA-TM-X-64688) Avail: NTIS HC $3.00 CSCL 14B

The use of the mask and pattern facility to include information on equipment accuracy, limitations, and pattern making capabilities is discussed. An insight is provided into potential areas of pattern applications, the sequence of mask making, as well as possible inputs and outputs available to the user. Author

N72-31289# Australian National Univ., Canberra. Dept. of Physics.
THE STARTING PROCESS IN THE NOZZLE OF A NONREFLECTED SHOCK TUNNEL
R. J. Stalker and N. R. Mudford 3 Apr. 1972 29 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Feb. 1973
Avail: NTIS HC $3.50 CSCL 14B

An approximate analysis is developed which describes the trajectory of the starting shock system in the nozzle of a nonreflected shock tunnel. It is shown that, by establishing a prior steady flow in the nozzle, maximum test times can be achieved without the use of a diaphragm at the nozzle entrance. In experiments at shock speeds up to 8 km/sec. it was found that use of this technique allowed more than half of the test time available in the primary shock tube flow to be realized in the hypersonic test section. Author

N72-31290# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
VACUUM SYSTEM FOR THE STUDY OF ELECTRONIC EMISSION BY IONIC BOMBARDMENT
F. Catoni and G. Cipolloni 7 Sep. 1971 29 p refs In ITALIAN (RT/EL-(71)4) Avail: AEC Depository Libraries

A vacuum system for studies on electron emission from semiconductors by ions has been built. The problems of ultrahigh vacuum obtainment are discussed. Evidence was found for the presence of an organic contamination. Preliminary studies for a better understanding of this effect, which can be of great technological importance, are described. Author (NSA)

N72-31291# Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany).
VICKSI: PROPOSAL FOR A VAN DE GRAAFF CYCLOTRON COMBINATION FOR ACCELERATION OF MEDIUM HEAVY IONS
Jan. 1972 54 p refs In GERMAN
(HM-B-118) Avail: AEC Depository Libraries

To accelerate heavy ions it was proposed a separated-magnet cyclotron be installed. The existing 7 MV Van de Graaff will be used as injector. Beams of 100 particle nA are anticipated with an energy resolution of 0.001. The facility will deliver beams in a range of ion mass and energy that has not been well covered so far. This will allow to systematically investigate a broad range of problems in nuclear, atomic, and solid-state physics. Cost estimates are presented. Author (NSA)

N72-31292# Institut Franco-Allemand de Recherches, St. Louis (France).
SURVEY OF THE ACTIVITIES OF THE INSTITUT FRANCO-ALLEMAND DE RECHERCHES IN THE FIELD OF AERONAUTICS [APERCU DES ACTIVITES DE L'ISL INTERESSANT L'AERONAUTIQUE]
A. Auriol 15 Nov. 1971 26 p refs In FRENCH Presented at the 8th Assoc. Franc. des Ingr. et Techniciens de l'Aeron. et de l'Espace Colloq. on Aerodynamique Appl., St. Louis, France, 8-10 Nov., 1971
(ISL-32/71) Avail: NTIS HC $3.50

Different ISL test facilities for aeronautical applications are described including launch range light gas guns, blast simulators, sonic bang generators and shock tubes. The role of ISL in the Franco-German cooperation program is mentioned. ESRO

N72-31293# Institut Franco-Allemand de Recherches, St. Louis (France).
USE OF A LIGHT GAS GUN AS A GENERATOR OF STRONG SHOCK WAVES
J. P. Hancy and L. Bobin 29 Mar. 1972 22 p Presented at the 22nd ARA Meeting, Santa Barbara, Calif., 18-19 Apr. 1972
(Contract DTEN-71-70-181)
(ISL-8/72) Avail: NTIS HC $3.25

The propagation of strong shock waves in the air was investigated using a light gas gun. Because of the very high pressure levels attainable in the pump tube (equivalent to 10,000 bars), the light gas gun can then be regarded as a shock tube. Results of recent experiments performed with a 105 mm/20 mm light gas gun (105 mm = diameter of the pump tube; 20 mm = diameter of the launch tube) are reported. The shock waves generated in the launch tube after bursting of the diaphragm and in absence of projectiles, attained more than 1,500 bars in successive steps (3 or 4), the first of which reached approximately 400 bars. Pressure records taken along the tube as a function of time showed that the shocks, although coalescing, decreased in intensity under the action of viscosity. It is apparent from computations based on Mollier's diagram of the air and the intensity of the shocks that the interface between the driver gas (hydrogen) and the air is located behind the shocks. Moreover a relatively good agreement was found between measured and calculated mean velocities of propagation.
Author (ESRO)

N72-31294# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
THE CALIBRATION AND DESCRIPTION OF A WIND-TUNNEL FOR STUDYING STRATIFIED FLOWS
Walter R. Debler and Richard D. Montgomery Dec. 1971 39 p ref
(Contract N00014-67-A-0181-0008)
(AD-743131; EM-71-2) Avail: NTIS CSCL 14/2

A wind-tunnel is described in which the air temperature can be varied in the vertical direction. The facility is used to study stratified flows. The velocity and temperature characteristics of the wind-tunnel were determined through a series of calibration tests. The results are presented herein. The performance of the wind tunnel is considered to be satisfactory for its intended purpose. Author (GRA)

N72-31295# Massachusetts Univ., Amherst. School of Engineering.
A WIND WAVE RESEARCH FACILITY
Joseph M. Colonell Mar. 1972 66 p refs
(Contracts N00014-68-A-0146-0009; N00014-68-A-0146-0017)
(AD-743068; UM-72-2) Avail: NTIS CSCL 14/2

The design, construction, and operational characteristics of the wind wave research facility at the University of Massachusetts (Amherst) are described in this report. Sample data on air flow and wave motion within the facility are included. A generalized computer program for random process data analysis, developed in conjunction with research in the facility, is appended to the report. Author (GRA)

N72-31296# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
EXPERIMENTAL SHORT-PULSE X RAY DETECTION SYSTEM Final Report, Jul. 1969 - Aug. 1971
Aug. 1971 64 p
(Contract DOT-FA69WA-2218)
(AD-742969; BSR-3164; FAA-RD-72-45) Avail: NTIS CSCL 01/2

The report covers the experimental study program to establish the design requirements of an operational system that can solve the problem of concealed weapon detection on personnel, using low level radiation X-rays. Author (GRA)

N72-31297# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION OF ANCILLARY ITEMS FOR XM18 AND XM19 LANDING MATS Final Report
Gordon L. Carr May 1972 128 p refs
(DA Proj. 1T0-62103-A-046)
(AD-743161; AEWES-Misc-Paper-S-72-16) Avail: NTIS CSCL 01/5

An investigation was conducted to evaluate ancillary items for use with XM18 and XM19 landing mats. Traffic and field tests were conducted to obtain information for use in comparing the performance life of the ancillary items with the performance life requirement for landing mat. Various turn adapters, access adapters, starting connectors, half panels, repair panels, closure panels, edge anchors, anchor attachments, and turndown adapters were tested. Engineer design tests were conducted on matsurfaced prepared subgrades, with a rolling wheel load simulating actual aircraft operations. Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-31298*# Illinois Univ., Urbana. Engineering Experiment Station.
A STUDY OF NOZZLE AND EJECTOR FLOW PROBLEMS BY THE METHOD OF INTEGRAL RELATIONS
L. D. Howlett and W. L. Chow Jun. 1972 84 p refs
(Grant NGL-14-005-140)
(NASA-CR-128066; UILU-ENG-72-4002; ME-TR-395-2) Avail: NTIS HC $6.25 CSCL 20D

The application of the method of integral relations to nozzle and ejector flow problems was examined. For nozzle flow problems, the general formulation is that the approaching flow may be rotational. Particular attention was given to the

phenomenon of choking under nonuniform flow conditions. Numerical integration of the governing ordinary differential equations was also investigated. This scheme of analysis was also applied to study the interacting flow field within an ejector system. Author

N72-31299# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE RADIAL DISTRIBUTION FUNCTION FOR THE FLUID OF HARD SPHERES AT HIGH DENSITIES. MEAN SPHERICAL INTEGRAL EQUATION APPROACH
Eduardo Waisman May 1972 8 p refs
(LPTHE-72/16) Avail: NTIS HC $3.00

A radical distribution function for hard spheres is obtained, which improves at high densities the Percus-Yevick one. This is achieved by solving the mean spherical integral equation for a Yukawa from, adjusted to satisfy the Carnahan-Starling equation of state. The solution to the related problem of the mean spherical model approximation for a model fluid which interacts via the hard sphere potential plus the Yukawa potential is reported. Author

N72-31300*# California Univ., Los Angeles. Dept. of Physics.
TURBULENCE STRUCTURE OF FINITE-beta PERPENDICULAR FAST SHOCKS
F. V. Coroniti Apr. 1970 34 p refs
(Grant NGR-05-007-116)
(NASA-CR-122464; R-69) Avail: NTIS HC $3.75 CSCL 20D

In a finite-beta plasma ion cyclotron, radius dispersion which forms a trailing wave train for a perpendicular fast shock is examined. Collisionless dissipation is provided by the three wave decay of the wave train into very oblique fast and parallel Alfven waves. Particle thermalization results from Landau damping of oblique fast wave turbulence. The shock damping length to three wave decay is many ion cyclotron radii. Undamped Alfven turbulence should persist far downstream from the shock.
Author

N72-31301# Lockheed Missiles and Space Co., Palo Alto, Calif.
APPLICATION OF SMOOTHING TO THE ANALYSIS OF DISCONTINUOUS FLOWS
G. S. Rosliakov and V. P. Sukhorkov 1970 7 p refs Transl. into ENGLISH from the book " Vychislitelnye Metody i Programmirovanie" Moscow, Moscow Univ. Press, 1970 p 121-129
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill., 60616

It is shown that smoothing in even the simplest form can be applied to solve a number of gas dynamic problems. The efficiency of the method is raised if a dependence of the coefficients on the solution (on the gradients of the quantities to be determined) is introduced. Author

N72-31302# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPTIMALITY CONDITIONS FOR A PROBLEM OF VERTICAL LIFT WITH A VARIABLE MASS
O. F. Makarov 1972 4 p refs Transl. into ENGLISH from Prikhl. Mekh. (USSR), v. 8, no. 5, 1972 p 131-134
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The equation for vertical lift of a variable mass point in a homogeneous gravity field is used to solve the problem of finding the motion regime maximizing the increment in the point velocity. A formula is derived that considers the point to possess a given store of energy. This is an isoperimetric problem of the maximum of the functional for a given value of the functional. An example calculation considers the velocity contribution to the payload of an n-stage rocket whose stage engines are connected without break. G.G.

N72-31303*# General Applied Science Labs., Inc., Westbury, N.Y.
NONUNIFORM FLOW FIELD GENERATION FOR SUPERSONIC COMPRESSOR STATOR DEVELOPMENT: DESIGN AND PRELIMINARY RESULTS Final Report
Frederick W. Lipfert and Irving Fruchtman May 1972 73 p refs
(Contract NAS1-10004)
(NASA-CR-112097; GASL-TR-759) Avail: NTIS HC $5.75 CSCL 20D

Design and preliminary results are given for a technique which can generate a nonuniform flow similar to the discharge of an impulse supersonic compressor rotor. The technique utilizes a carefully contoured, two-dimensional blunt body in a conventional hypersonic wind tunnel to generate the required flow field. To show the effects of the flow vorticity, a cascade of impulse-type blades was tested in this test stream. Some preliminary performance data are given along with comparison with previously determined uniform flow results. Author

N72-31304# Sandia Labs., Albuquerque, N.Mex.
SOLUTION FOR THE THREE-DIMENSIONAL ENERGY SPECTRUM IN A HOMOGENEOUS ISOTROPIC INCOMPRESSIBLE TURBULENT FIELD
R. L. Fox Mar. 1972 51 p refs Sponsored by AEC
(SC-RR-720089) Avail: NTIS

The method of multipoint distribution functions is used to calculate the decay of the homogeneous, turbulent energy spectrum from a given initial state. Solutions for the energy spectrum are obtained for two approximate forms of the turbulent hierachy of equations. An expansion in Hermite tensors in velocity space is used for the two-point correlation function. The effect of truncation of the velocity space expansion is examined. The time evolution of the energy spectrum is calculated for several hypothetical initial configurations in order to examine the influence of various physical parameters. The predicted decay of experimentally measured initial energy spectrum is developed and compared with data obtained by M. S. Uberoi. The Kolmogoroff spectrum law is obtained for appropriate wave number regions. Reasonable agreement between the experimental data and the theoretical predictions is obtained. Author

N72-31305# Cambridge Univ. (England). Dept. of Engineering.
VIBRATION AND SOUND GENERATION IN A CASCADE OF FLAT PLATES IN SUBSONIC FLOW
D. S. Whitehead London Aeron. Res. Council 1972 44 p refs Supersedes ARC-32017 Sponsored by Min. of Technol.
(ARC-R/M-3685; ARC-32017) Avail: NTIS HC $4.25; HMSO £1.60; PHI $6.25

Particulars are given of a method of calculation, which has been programmed for a digital computer, for linearized two-dimensional subsonic unsteady flow through a cascade of flat plates operating at zero mean incidence. Inputs to the calculation are motion of the blades due to either bending or torsional vibration, wakes from moving obstructions upstream of the cascade, and incoming acoustic waves. For each of these inputs the output gives the force and moment on the blades, the wakes shed from the trailing edges, and the outgoing acoustic waves. The program therefore provides all the information necessary for calculation of forced and self-excited vibration of the blades, and for the generation, transmission, and reflection of acoustic waves by a cascade. Two kinds of acoustic resonance are found, one corresponding to resonance of an annular duct without blades, and the other being an acoustic resonance in the passages between the blades. Author (ESRO)

N72-31306# National Gas Turbine Establishment, Farnborough (England).
A STREAMLINE CURVATURE THROUGH-FLOW COMPUTER PROGRAM FOR ANALYSING THE FLOW THROUGH AXIAL-FLOW TURBOMACHINES
D. H. Frost London Aeron. Res. Council 1972 37 p refs Supersedes NGTE-R-312; ARC-32776

(ARC-R/M-3687; NGTE-R-312; ARC-32776) Avail: NTIS HC $4.00; HMSO £1.30; PHI $5.30

A computer program for the analysis of the fluid motion in the meridional plane of axial flow turbomachines is described. The method uses a streamline curvature approach and the program allows calculations within blade rows. Comparisons with experiment and various other methods of analysis are presented. Author (ESRO)

N72-31307# Aeronautical Research Council, London (England).
FORTRAN PROGRAMMES FOR AXISYMMETRIC POTENTIAL FLOW AROUND CLOSED AND SEMI-INFINITE BODIES
C. M. Albone 1972 41 p refs Supersedes ARC-32346
(ARC-CP-1216; ARC-32346) Avail: NTIS HC $4.25; HMSO 65p; PHI 2.75

Two programs are presented in ICL FORTRAN, for the pressure distribution on the surface of an arbitary body of revolution in axisymmetric, incompressible flow. One program evaluates the pressure distribution on an arbitary closed body of revolution. The second deals with a body which has a parallel afterbody extending to infinity downstream. Listings for each program are given. Results from both programs are presented and their accuracy is demonstrated. The range of bodies for which the programs work is also shown. Author (ESRO)

N72-31308# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
AN EDDY VISCOSITY MODEL FOR HYPERMIXING JETS AND WAKES Final Report
Paul M. Bevilaqua Apr. 1972 28 p refs
(AD-743297; ARL-72-0047) Avail: NTIS CSCL 20/4

The effect of discrete vortices on the structure of turbulent free shear flows is considered. It is found that by relating the mixing length and velocity of an eddy viscosity to the vortex size and rotational speed, an analytic description of the hypermixing phenomenon is obtained. This new model is successfully applied to the two dimensional turbulent wake. Author (GRA)

N72-31309# Naval Postgraduate School, Monterey, Calif.
JET PENETRATION AND INTERACTION AT A SONIC THROAT M.S. Thesis
Kenneth Edwin Frick Mar. 1972 77 p refs
(AD-743079) Avail: NTIS CSCL 20/4

The thesis describes the results of an investigation of the throttling effects of a transverse jet when injected into a sonic throat. The process, commonly referred to as aerodynamic throttling, was studied both analytically and experimentally. An analytical model is developed utilizing momentum considerations. This model successfully predicts the measured throttling results for 90 degree injection and mainstream flow reductions up to approximately 60 percent. An experimental program is described in which a two-dimensional nitrogen jet is injected into the mainstream through slots of various widths and inclinations. Visual flow patterns are shown to qualitatively describe the nature of the interaction between the jet and the mainstream. Author (GRA)

N72-31310# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
DYNAMIC MODELING OF THE BISTABLE FLUID AMPLIFIER
James P. Ries Jan. 1972 76 p refs
(Contract N00014-69-A-0417)
(AD-743201; THEMIS-LU-TR-8) Avail: NTIS CSCL 13/7

An analytical model for the dynamic response of a bistable fluid amplifier with straight walls is presented. The model represents the dynamic changes which take place in an amplifier during the early phases of switching. The state of the amplifier at any instant of time is identified by a set of system equations whose input function is the mass flow rate from the control port. The system variables, constants and equations are arranged in nondimensional form in order to organize and facilitate the solution. In the second half of the report, the system equations are used to prepare an analog simulation of the amplifier. The coupling between system variables and the feedback mechanisms present in the model can be easily identified from this simulation. Author (GRA)

N72-31311# Naval Ship Research and Development Center, Bethesda, Md.
CORRELATION OF RESISTANCE TEST RESULTS FROM FIXED-AND FREE-TO-TRIM METHODS FOR A DYNAMIC LIFT CRAFT MODEL 4667
Nadine Hubble Apr. 1972 96 p refs
(SS Proj. 4606)
(AD-742752; NSRDC-3544) Avail: NTIS CSCL 20/4

Customary methods are discussed for determining the resistance characteristics in smooth water of hulls of planing and hydrofoil craft. Results are presented and compared for a hull, with possible application to either type of craft, which has been tested by both the fixed-trim method, generally used for hydrofoil craft, and the free-to-trim method, generally used for planing craft. Recommendations are made for conducting future resistance tests of dynamic-lift craft, i.e., both planing and hydrofoil hulls, in the fixed-trim mode as well as for converting the data to the form of free-to-trim test data to facilitate general design studies for both types of craft. Author (GRA)

N72-31312# Johns Hopkins Univ., Baltimore, Md.
SOME PROPERTIES OF TURBULENCE IN A STRATIFIED SHEARING FLOW
Robert R. Long May 1972 45 p refs
(Contract N00014-67-A-0163-0013)
(AD-742831; TR-2-Ser-C) Avail: NTIS CSCL 20/4

The report contains a description of research closely connected to an experimental investigation of turbulent, stratified, shearing flow. The experiment is one of the simplest in which three basic properties of a turbulent flow - stratification, energy dissipation and shear - are present, and it is hoped that a good understanding of this experiment will lead to useful information about turbulent processes in the atmosphere and oceans and other density-stratified fluid systems. Author (GRA)

N72-31313# Wisconsin Univ., Madison. Mathematics Research Center.
ASYMPTOTIC THEORY OF HELICAL WAVES ON A GASEOUS JET IN ROTATING VISCOUS FLUID
M. C. Shen Dec. 1971 27 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-742910; MRC-TSR-1175) Avail: NTIS CSCL 20/4

A nonlinear asymptotic theory within the framework of long-wave approximation is developed for the study of helical waves on a rotating viscous fluid with a cylindrical free surface, and the mathematical model considered is relevant to problems of geophysical significance. A unified approach to the derivation of asymptotic equations is achieved, and for the sake of practical application the range of validity of each equation is clearly stated in terms of physical scales. The theory also yields asymptotically without direct computation the stability region for the wave motion, hence suggests an effective method to deal with stability problems of viscous fluid flow with free surface. Author (GRA)

N72-31314# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TWO PHASE FLOWS AND PROBLEMS OF HEAT EXCHANGE (SELECTED ARTICLES)
I. T. Aladev, S. V. Teplov, I. M. Pchelkin, D. D. Kalafati, N. S. Kondratyev et al 10 Feb. 1972 77 p refs Transl. into ENGLISH from the book "Dvukhfaznye Potoki i Vopr. Teploobmena" Moscow, Izd. Vo Nauka, 1970 p 5-25, 32-42, 49-53
(AD-742697; FTD-MT-24-1023-71) Avail: NTIS CSCL 20/4

Contents: Effective electrical conductivity of a two-phase

gas/liquid-metal flow; Method for determining true phase velocities with mass transfer; Investigation of expansion of the mixture water-air in a Laval nozzle; Experimental apparatus for investigating two-phase nozzles with a vapor-water mixture; Thermodynamic analysis of the potassium-water binary cycle; Study of heat transfer with complete condensation of potassium vapor in a horizontal tube; Thermal phase resistance during condensation. GRA

N72-31315# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT AND MASS EXCHANGE IN A POROUS SOLID AND ITS CIRCUMFLUOUS LAMINAR FLOW WHEN CHEMICAL REACTIONS ARE PRESENT ON THE WALL SURFACE
G. T. Sergeyev 25 Feb. 1972 13 p refs Transl. into ENGLISH from the book "Tepl.-i Massoobmen Pri Fazovykh i Khim. Prevrashcheniyakh." Minsk, 1968 p 91-99
(AD-742694; FTD-HT-23-1238-71) Avail: NTIS CSCL 20/4

A study is reported of the nonstationary (in view of the ablation of the porous solid) laminar boundary layer under conditions of the reaction of the material of porous graphite wall and a gas (hydrogen) introduced through it with the oxygen of the outer stream at a finitely high rate of heterogeneous and homogeneous reactions. It takes into consideration the internal and external heat and mass transfers of the multicomponential gas. It examines a mode of ablation. The equations of the boundary layer of compressed gas are transformed to a relatively simple form. For the case where the Prandtl and Schmidt numbers are equal to unity, a solution of the problem is obtained in a closed form. Author (GRA)

N72-31316# Rochester Applied Science Associates, Inc., N.Y.
AN INVESTIGATION OF THE MIXING OF LINEAR AND SWIRLING FLOWS Final Technical Report, 15 Feb. 1971 - 14 Feb. 1972
Richard P. White, Jr. and John C. Balcerak Feb. 1972 86 p refs
(Contract N00014-71-C-0226; NR Proj. 215-170)
(AD-742854; RASA-72-04) Avail: NTIS CSCL 20/4

A research program was conducted to study in detail the importance of various aerodynamic and geometric parameters on the dissipation of a concentrated trailed vortex in which the dissipation is greatly enhanced by the continuous injection of a mass of air into its core. The basic results of the research program demonstrated that the efficiency of vortex dissipation would be maximized by designing the injection system so that the vortex was injected at its center and parallel to the axis of the trailed vortex core with a linearly-directed mass of air at sonic speeds. The efficiency of the optimum system was shown to be almost an order of magnitude better than had been demonstrated previously. Author (GRA)

N72-31317# Naval Postgraduate School, Monterey, Calif.
A STUDY OF SUPERSONIC FLOW PAST VIBRATING PANELS AND SHELLS M.S. Thesis
Kenneth Allen Webster Mar. 1972 99 p refs
(AD-742923) Avail: NTIS CSCL 20/4

Supersonic flow past harmonically vibrating two-dimensional panels and cylindrical shells is analyzed using a linearized method-of-characteristics procedure. A detailed description of this method to solve the linearized unsteady potential equation is given and numerical results are presented to indicate the nature of the aerodynamic pressure distributions. Also, comparisons of the present results are made with earlier work based upon quite different approaches. Author (GRA)

N72-31318# Ballistic Research Labs., Aberdeen Proving Ground, Md.
NUMERICAL EXPERIMENTS TO INTEGRATE THE NAVIER-STOKES EQUATIONS
Clarence W. Kitchens, Jr. Apr. 1972 49 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-743182; BRL-1580) Avail: NTIS CSCL 20/4

A series of numerical experiments are described which solve for the time dependent flow field around a circular cylinder accelerated to supersonic speeds. The study is performed using a computer program developed by Scala and Gordon which models the full time-dependent Navier-Stokes equations. Results are presented for Mach two flow past a cylinder at freestream Reynolds numbers of 15.0, 46.8, 157.2, and 704.6, based on cylinder diameter. The numerical results are compared with analytical solutions and experimental measurements and the accuracy of the numerical results is discussed. These comparisons show where the author's numerical solutions of the Navier-Stokes equations fail to give accurate results. Author (GRA)

N72-31319# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF DETERMINING THE COEFFICIENT OF VISCOUS FRICTION
S. Kornacki 4 Apr. 1972 8 p refs Transl. into ENGLISH from Pomiary, Automat., Kontr. (Poland), v. 17, no. 4, 1971 p 182-183
(AD-743143; FTD-HC-23-1919-71) Avail: NTIS CSCL 13/7

The author gives a method of determining the coefficient of viscous friction in hydraulic elements, based on utilization of the properties of frequency phase diagram, the method permitting measurements in actual operating conditions of the element. A measuring system for the case of a control slide value is proposed. Author (GRA)

N72-31320# Naval Ship Research and Development Center, Bethesda, Md.
LAMINAR FLOWS PAST ELLIPTIC CYLINDERS AT VARIOUS ANGLES OF ATTACK
Hans J. Lugt and Henry J. Haussling Feb. 1972 61 p refs (ZR0110101)
(AD-743054; NSRDC-3748) Avail: NTIS CSCL 20/4

Numerical solutions for laminar incompressible fluid flows past thin elliptic cylinders at various angles of attack were obtained using a stream function-vorticity formulation. The flow is considered to be two-dimensional and time-dependent. Potential flow was selected as the initial condition. Almost steady state solutions were computed for cases alpha = 0 deg, Re = 200; alpha = 45 deg, Re = 15; and alpha = 90 deg, Re = 10 where alpha and Re are the angle of attack and the Reynolds number, respectively. Vortex shedding was studied for alpha = 45 deg, Re = 30 and 200. Author (GRA)

N72-31321# Naval Ship Research and Development Center, Bethesda, Md.
THE TORQUE AND TURBULENT BOUNDARY LAYER OF ROTATING DISKS WITH SMOOTH AND ROUGH SURFACES, AND IN DRAG REDUCING POLYMER SOLUTIONS
Paul S. Granville Apr. 1972 54 p refs
(AD-743053; NSRDC-3711) Avail: NTIS CSCL 20/4

The resisting torque of disks rotating in an unbounded fluid was analyzed on the basis of three-dimensional boundary layer theory. Smooth and rough surfaces in ordinary fluids and in drag-reducing polymer solutions were considered. A general logarithmic relation was derived for the torque as a function of Reynolds number for arbitrary roughness and drag reduction. Special formulas were obtained for smooth surfaces, fully rough surfaces, polymer solutions with a linear logarithmic drag reduction characterization, and polymer solutions with maximum drag reduction. Relations were also obtained for boundary layer parameters such as thickness, wall shearing stress, etc. Author

N72-31322# Minnesota Univ., Minneapolis. Heat Transfer Lab.
EXPERIMENTAL TURBULENT VISCOSITIES FOR SWIRLING FLOW IN A STATIONARY ANNULUS
Charles J. Scott and Dean R. Rask 1 Aug. 1971 110 p refs

(Contract DAHC04-67-C-0021)
(AD-742722; HTL-94; AROD-6612-7-E) Avail: NTIS CSCL 20/4

An important feature of many flows encountered in practice (such as in turbomachinery) is the fact that the streamlines may be curved, thereby introducing a pressure gradient in the direction perpendicular to the main flow direction. The purpose of the present research is to isolate the effects of curvature (swirl) on the turbulence and hence the transport properties. The experimental effort is concerned with mapping out the details of the developing axial and decaying tangential velocity fields using isothermal air as the working fluid in an annulus with a single diameter ratio (di/do) = 0.4) and at a single bulk Reynolds number of 130,000. Interest is centered on a critical discussion of the data reduction techniques for obtaining the radial variations of the axial and tangential momentum diffusivities.
Author (GRA)

N72-31323# California Inst. of Tech., Pasadena.
BEHAVIOR OF SPHERICAL PARTICLES AT LOW REYNOLDS NUMBERS IN A FLUCTUATING TRANSLATIONAL FLOW, PRELIMINARY EXPERIMENTS Final Report, 1 Sep. 1970 - 31 Aug. 1971
Murray K. Hill and Edward E. Zukoski Jan. 1972 38 p refs
(Contract F33615-69-C-1069; AF Proj. 7176)
(AD-742992; ARL-72-0017; FR-1) Avail: NTIS CSCL 20/4

The behavior of small spheres in non-steady translational flow has been studied experimentally for values of Reynolds numbers from 0 to 3000. The aim of the work was to improve the quantitative understanding of particle transport in turbulent gaseous media, a process of extreme importance in powerplants and energy transfer mechanisms. Particles, subjected to strong sinusoidal oscillations parallel to the direction of steady translation, were studied for changes in average drag coefficient depending upon translational Reynolds number, the frequency, and amplitude of the oscillations. The occurrence of maximum effect suggests non-linear interaction between wake vortex shedding and the oscillation. GRA

N72-31324# Tennessee Univ., Knoxville. Dept. of Engineering Mechanics.
A THEORETICAL AND EXPERIMENTAL STUDY OF LAMINAR FLOW BETWEEN A STATIONARY POROUS DISK AND A ROTATING NONPOROUS DISK
Chyan Shiang Chiou Jun. 1972 134 p refs
(Contract N00014-68-A-0144)
(AD-744021; EM-72-3) Avail: NTIS CSCL 13/9

Laminar flow of a fluid flowing radially outward in the gap between a stationary porous disk and a parallel rotating nonporous disk, through which the fluid is injected, was studied theoretically and experimentally. The special case with both disks stationary was also included. Special attention was given to the range of injection Reynolds number and rotational parameter needed for comparison with experimental pressure distributions and resistance torques. The experiments were carried out with air flowing between disks 5 inches in diameter. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-31325 Kodaikanal Observatory (India).
SUMMARY OF MAGNETIC AND IONOSPHERIC OBSERVATIONS, JANUARY - JUNE 1967
1970 240 p
(DGO-11-198) Copyright. Avail: Issuing Activity

The magnetic data given are derived mainly from the records of La Cour instruments, but in case of failure of La Cour magnetograph, Watson magnetograms were used. Half-hourly values are given for eleven ionospheric parameters viz., foF2, foF1, foE, foEs, fbEs, f min, h F2, h F, h E, h Es and (M3000) F2 with symbols and terminology as recommended by the Special Committee on Worldwide Ionospheric Soundings to the URSI/AGI in its first report (Brussels, 2 September 1956) with subsequent amendments. Author

N72-31326 Department of Energy, Mines and Resources, Ottawa (Ontario).
WATER RESOURCES Resource Satellites and Remote Airborne Sensing for Canada Report No. 8
Dennis White, ed. 1971 32 p refs
(M75-2/8) Copyright. Avail: Issuing Activity

The importance of remote sensing technology to measurements of water resource parameters is discussed and recommendations of a national organization and program to satisfy the remote sensing needs of potential Canadian users are presented. The committee concluded that remote sensing of water quantity and quality variables may have important social and economic benefits. Author

N72-31327*# Wisconsin Univ., Madison.
EVALUATION OF THE APPLICATION OF ERTS-A DATA TO THE REGIONAL LAND USE PLANNING PROCESS Progress Report, period ending 1 Aug. 1972
James L. Clapp, Principal Investigator 1 Aug. 1972 12 p
Sponsored by NASA
(E72-10036; NASA-CR-127484) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N72-31328*# California Univ., Riverside. Dept. of Plant Sciences.
EVALUATION OF REMOTE SENSING IN CONTROL OF PINK BOLLWORM IN COTTON Progress Report, Jul. 1972
Lowell N. Lewis, Principal Investigator and Virginia Coleman 18 Sep. 1972 1 p
(Contract NAS5-21771)
(E72-10037; NASA-CR-127886) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N72-31329*# Geological Survey, Washington, D.C.
CARTOGRAPHIC APPLICATION OF ERTS IMAGERY
Alden P. Colvocoresses, Principal Investigator 20 Sep. 1972 12 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Original contains color illustrations. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70243AG-2)
(E72-10038; NASA-CR-128119) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report. Results of a quick look of selected ERTS-1 imagery with respect to cartographic applications and products are presented. The term cartographic is applied to graphics that have been related to an accepted reference figure of the earth within a prescribed degree of accuracy. The results are presented in the form of figures covering: (1) nongeometric relative image quality; (2) geometric properties (preliminary); (3) first phase photoimage products; (4) intermediate phase photoimage products; (5) optimum phase orthophotoquad products; and (6) cartographic applications. Because of its unique vantage point of 920 km, ERTS-1 will be a powerful mapping tool by providing extensive and continuous up-to-date data. A.L.

N72-31330*# Dartmouth Coll., Hanover, N.H.
URBAN-FIELD LAND USE IN SOUTHERN NEW ENGLAND: A FIRST LOOK
Robert B. Simpson, Principal Investigator 28 Sep. 1972 7 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Original contains color illustrations. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21749)
(E72-10039; NASA-CR-128120) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report. First look evaluation of ERTS-1 multiband imagery for urban-field land use applications revealed a great deal of potentially valuable information. The amount of land use detail which can be extracted confidently from ERTS imagery is encouraging, and the objectives of the proposed project are considered feasible providing timely cloud-free coverage is available. A.L.

N72-31331*# Geological Survey, Washington, D.C.
GEOLOGICAL QUESTIONS AND SIGNIFICANT RESULTS PROVIDED BY EARLY ERTS-1 DATA
William D. Carter 22 Sep. 1972 11 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Sponsored by NASA
(E72-10040; NASA-CR-128121) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report. The organization for evaluating the uses of Earth Resources Technology Satellite data of the United States and foreign areas is described. The implementation of a system to disseminate the data to the geographical areas of interest is discussed. Brief descriptions are included of data received for the following areas: (1) east coast, (2) central United States, (3) western mountain areas, (4) west coast areas, and (5) Alaska. It is concluded that the multiband approach is useful with each of the bands providing unique and useful information. The difficulties in handling the data if all seven bands are used are examined. P.N.F.

N72-31332*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A FIRST LOOK AT GEOLOGICAL ASPECTS OF ERTS IMAGERY OF WYOMING
N. Short 29 Sep. 1972 2 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(E72-10041; NASA-TM-X-68776) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report. The analysis of six MSS-5 frames covering most of the western half of Wyoming is discussed. The frames under consideration covered the following areas: (1) Rock Springs, (2) Western Wind River Basin, and (3) Bighorn Basin-Absarokas Mountains. Miscellaneous observations concerning identification of natural and man-made structures are included. P.N.F.

N72-31333*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A FIRST-LOOK MACHINE ANALYSIS OF ERTS-1 DATA
David A. Landgrebe, Principal Investigator, R. M. Hoffer, Principal Investigator, and F. E. Goodrick 29 Sep. 1972 22 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Original contains color illustrations. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21773)
(E72-10042; NASA-CR-128122) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report. The preliminary analysis of a black and white image of channel 5 data together with tapes from the multispectral scanner is discussed. Four sub-projects based on the initial analysis are discussed. The sub-projects are the analysis by multispectral pattern recognition techniques of the full frame and two particular subframes and a study of the data quality. The procedures for conducting the study and the limitations in analyzing the data are examined. Methods for improving the analysis of the frames by first and second iteration are presented. P.N.F.

N72-31334*# Corps of Engineers, Washington, D.C. Coastal Engineering Research Center.
COASTAL APPLICATIONS OF THE ERTS-1 SATELLITE IMAGERY
Orville T. Magoon, Principal Investigator 29 Sep. 1972 17 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(NASA Order S-70257AG)
(E72-10043; NASA-CR-128123) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report. Samples are given of the possible applications of ERTS-1 imagery to coastal and nearshore studies. Briefly discussed are: (1) obtaining regional views of extended coastal areas; (2) distribution of sediments; (3) coastal configurations and changes; (4) barrier islands; (5) underwater penetration, and (6) coastal waves. A.L.

N72-31335*# Long Island Univ., Greenvale, N.Y.
A STUDY OF THE ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS
Edward Yost, Principal Investigator 29 Sep. 1972 4 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(Contract NAS5-21799)
(E72-10044; NASA-CR-128124) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report. ERTS-1 imagery was received from NASA in both positive and negative form. This imagery was analyzed to determine the hydrologic features of the water mass, including current patterns, particulate in suspension, and the contacts between different water masses, as well as coastal marsh characteristics. A Spectral Data Model 64 multispectral projector/viewer was used for the analysis. Quick look analysis of the second generation negatives indicated that: (1) green spectral band lacked contrast and was overexposed; (2) red spectral had acceptable contrast, but somewhat overexposed; and (3) infrared bands overexposed for land areas, but exposure good for water. Analysis of second generation positives indicated that; (1) green spectral band extremely flat; (2) red spectral band of acceptable contrast, but too dense for projection; and (3) infrared bands lacked detail in both water and land areas. Photographs indicate that it is necessary to expose and process the multispectral imagery for the scene brightness range under consideration. A.L.

N72-31336*# Geological Survey, Washington, D.C. Information Office.
ERTS PHOTOGRAPHY ALREADY USEFUL
James F. Daniel, Principal Investigator, Alden P. Colvocoresses, Principal Investigator, , James R. Wray, Principal Investigator, and William D. Carter 29 Sep. 1972 3 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Sponsored by NASA Original contains color illustrations. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S.D. 57198

(E72-10045) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N72-31337*# California Univ., Berkeley. Space Sciences Lab.
ERTS-1 APPLICATIONS TO CALIFORNIA RESOURCE INVENTORY
Robert N. Colwell, Principal Investigator 29 Sep. 1972 7 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Original contains color illustrations. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S.D. 57198
(Contract NAS5-21827)
(E72-10046; NASA-CR-128125) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report. ERTS-1 information will be utilized by resource management groups working in the fields of forestry, hydrology, range management, and agriculture to develop resource inventories of the state of California. Five examples are given of the use of ERTS-1 imagery and aerial photography in identifying different crops and field conditions. A.L.

N72-31338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHLOROPHYLL STRUCTURE IN THE OCEAN
Karl Heinz Szekielda, Principal Investigator and Robert J. Curran 29 Sep. 1972 2 p refs Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md. 29 Sep. 1972 Prepared in cooperation with Delaware Univ.
(Contract NAS5-21784)
(E72-10047; NASA-TM-X-68605) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N72-31339*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY GEOLOGIC EVALUATION OF ERTS IMAGERY
Paul D. Lowman, Jr. 29 Sep. 1972 3 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Original contains color illustrations. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(E72-10048; NASA-TM-X-68606) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N72-31340*# General Electric Co., Philadelphia, Pa.
QUICK LOOK ANALYSIS OF LOS ANGELES TEST SITE SCENE WITH GENERAL ELECTRIC MULTISPECTRAL INFORMATION EXTRACTOR SYSTEM (GEMS)
Surendra Anant Raje, Principal Investigator and Richard Economy 29 Sep. 1972 2 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(Contract NAS5-21797)
(E72-10049; NASA-CR-128051) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N72-31341*# Environmental Research Inst. of Michigan, Ann Arbor.
COMPUTER PROCESSING OF ERTS-1 MSS DATA FROM THE SAN FRANCISCO FRAME
F. J. Thomson, Principal Investigator, M. Gordon, and J. Morgenstern 29 Sep. 1972 2 p ref Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Sponsored by NASA
(E72-10050; NASA-CR-128052; Rept-011229-4-S) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N72-31342*# International Business Machines Corp., Gaithersburg, Md.
ERTS-1 ANALYSIS IN THE MONTEREY BAY AREA, USING DIGITAL TAPES
Ralph Bernstein, Principal Investigator and Charles Sheffield 27 Sep. 1972 1 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Sponsored by NASA Prepared in cooperation with Earth Satellite Corp.
(E72-10051; NASA-CR-128053) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N72-31343*# Michigan Univ., Ann Arbor. Willow Run Labs.
DETECTION OF DUMPING IN THE NEW YORK BIGHT
C. T. Wezernak, Principal Investigator and F. J. Thomson, Principal Investigator 25 Sep. 1972 2 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(Contract NAS5-21783-1)
(E72-10052; NASA-CR-128054) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N72-31344*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
DELINEATION OF PERMAFROST BOUNDARIES AND HYDROLOGIC RELATIONSHIPS
Duwayne M. Anderson, Principal Investigator 29 Sep. 1972 4 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(NASA Order S-70253AG)
(E72-10053; NASA-CR-128055) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N72-31345*# National Oceanic and Atmospheric Administration, Washington, D.C.
DETECTION OF ICE CONDITIONS IN THE QUEEN ELIZABETH ISLANDS
E. Paul McClain 29 Sep. 1972 1 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Sponsored by NASA
(E72-10054; NASA-CR-128056) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N72-31346*# Geological Survey, Tacoma, Wash.
ANALYSIS OF ARCTIC ICE FEATURES
William I. Campbell and E. Paul McClain 29 Sep. 1972 2 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Sponsored by NASA
(E72-10055; NASA-CR-128057) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N72-31347*# National Oceanic and Atmospheric Administration, Washington, D.C.
DETECTION OF SNOW CONDITIONS IN MOUNTAINOUS TERRAIN
Donald R. Wiesnet, Principal Investigator 29 Sep. 1972 2 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(NASA Order S-70246AG)
(E72-10056; NASA-CR-128058) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N72-31348*# National Oceanic and Atmospheric Administration, Washington, D.C.
DETECTION OF CIRCULATION FEATURES IN THE GREAT LAKES
Alan E. Strong, Principal Investigator 29 Sep. 1972 1 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(NASA Order S-70246AG)
(E72-10057; NASA-CR-128059) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N72-31349*# Oregon State Univ., Corvallis.
THE ADVANTAGES OF SIDE-LAP STEREO INTERPRETATION OF ERTS-1 IMAGERY IN NORTHERN LATITUDES
Charles E. Poulton, Principal Investigator 29 Sep. 1972 4 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972 Sponsored by NASA
(E72-10058; NASA-CR-128060) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N72-31350*# American Univ., Washington, D.C.
INTERPRETATION OF WETLANDS ECOLOGY FROM ERTS
Richard R. Anderson, Principal Investigator, Virginia Carter, and Bill McGinness 29 Sep. 1972 1 p Presented as Preliminary Findings from Analyses of ERTS Observations, NASA Goddard Space Flight Center, Greenbelt, Md., 29 Sep. 1972
(Contract NAS5-21752)
(E72-10059; NASA-CR-128061) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N72-31351*# TRW Systems Group, Redondo Beach, Calif.
ERTS IMAGE DATA COMPRESSION TECHNIQUE EVALUATION Monthly Progress Report, period ending 1 Sep. 1972
Donald J. Spencer, Principal Investigator and Curtis L. May 5 Sep. 1972 1 p
(Contract NAS5-21746)
(E72-10067; NASA-CR-128034) Avail: NTIS HC $3.00 CSCL 09B

There are no author-identified significant results in this report.

N72-31352*# National Oceanic and Atmospheric Administration, Miami, Fla.
REMOTE SENSING OF OCEAN CURRENTS Bimonthly Report, 4 Jul. - 4 Sep. 1972
George A. Maul, Principal Investigator 8 Sep. 1972 7 p Sponsored by NASA
(E72-10068; NASA-CR-128083) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N72-31353*# Bendix Corp., Ann Arbor, Mich.
ECOLOGICAL EFFECTS OF STRIP MINING IN OHIO Progress Report, period ending 5 Aug. 1972
Phillip E. Chase, Principal Investigator 5 Aug. 1972 3 p
(Contract NAS5-21762)
(E72-10069; NASA-CR-128084; Rept-72-141-922) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N72-31354*# Argus Exploration Co., Los Angeles, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Progress Report, 15 Jun. - 31 Aug. 1972
Ira C. Bechtold, Principal Investigator 8 Sep. 1972 5 p
(Contract NAS5-21809)
(E72-10071; NASA-CR-128086) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N72-31355*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MAPPING OF THE MAJOR STRUCTURES OF THE AFRICAN RIFT SYSTEM Progress Report, 1 Jul. - 31 Aug. 1972
Paul Mohr, Principal Investigator 31 Aug. 1972 1 p
(Contract NAS5-21747)
(E72-10072; NASA-CR-128087) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N72-31356*# American Univ., Washington, D.C.
ERTS-1 DATA USER INVESTIGATION OF WETLAND ECOLOGY Progress Report
Richard R. Anderson, Principal Investigator 6 Sep. 1972 2 p Sponsored by NASA
(E72-10073; NASA-CR-128088; PR-2) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N72-31357*# Purdue Univ., Lafayette, Ind. Lab. for Application of Remote Sensing.
EVALUATION AND COMPARISON OF ERTS MEASUREMENTS OF MAJOR CROPS AND SOIL ASSOCIATIONS FOR SELECTED SITES IN THE CENTRAL UNITED STATES Progress Report, 1 Jul. - 31 Aug. 1972
Marion F. Baumgardner, Principal Investigator 5 Sep. 1972 3 p Sponsored by NASA
(E72-10075; NASA-CR-128090) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N72-31358*# Maine Dept. of Transportation, Augusta.
DETECTION AND MONITORING VEGETATION DAMAGE ASSOCIATED WITH HIGHWAYS AND HIGHWAY FACILITIES Progress Report, period ending 1 Sep. 1972
Ernest G. Stoeckler, Principal Investigator 1 Sep. 1972 1 p

Sponsored by NASA
(E72-10076; NASA-CR-128091; PR-2) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N72-31359*# Maine Dept. of Transportation, Augusta.
TO MAP THE DISTRIBUTION OF GLACIOFLUVIAL DEPOSITS AND ASSOCIATED GLACIAL LANDFORMS Progress Report, period ending 1 Sep. 1972
Raymond G. Woodman, Principal Investigator 1 Sep. 1972 2 p Sponsored by NASA
(E72-10077; NASA-CR-128092; PR-2) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N72-31360*# Aerospace Corp., Los Angeles, Calif.
STUDY TO DEMONSTRATE THE FEASIBILITY OF AND DETERMINE THE OPTIMUM METHOD OF REMOTE HAZE MONITORING BY SATELLITE Progress Report, 1 Jun. - 31 Jul. 1972
Ernest H. Rogers, Principal Investigator 31 Jul. 1972 1 p
(Contract NAS5-21719)
(E72-10078; NASA-CR-128093) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

N72-31361*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY Bimonthly Progress Report, 23 Jun. - 23 Aug. 1972
Duwayne M. Anderson, Principal Investigator, R. K. Haugen, L. W. Gatto, C. W. Slaughter, and T. Marlar 23 Aug. 1972 3 p Sponsored by NASA
(E72-10080; NASA-CR-128095; BMPR-1) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N72-31362*# Tennessee Univ., Knoxville. Dept. of Geography.
GEOGRAPHIC APPLICATIONS OF ERTS-1 IMAGERY TO RURAL LANSCAPE CHANGE Progress Report
John B. Rehder, Principal Investigator 21 Aug. 1972 3 p Sponsored by NASA
(E72-10082; NASA-CR-128097) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N72-31363*# Arizona Univ., Tucson. Dept of Biological Sciences.
STUDY OF THE MARINE ENVIRONMENT OF THE NORTHERN GULF OF CALIFORNIA Progress Report, period ending 31 Jul. 1972
J. R. Hendrickson, Principal Investigator 31 Jul. 1972 4 p
(Contract NAS5-21777)
(E72-10083; NASA-CR-128098) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N72-31364*# Environmental Research Inst. of Michigan, Ann Arbor.
BARGE DUMPING OF WASTES IN THE NEW YORK BIGHT
C. T. Wezernak, Principal Investigator and Fred J. Thomson, Principal Investigator 25 Sep. 1972 2 p Sponsored by NASA
(E72-10084; NASA-CR-128099; Rept-011229-6-S) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N72-31365*# Environmental Research Inst. of Michigan, Ann Arbor.
AN ERTS MULTISPECTRAL SCANNER EXPERIMENT FOR MAPPING IRON COMPOUNDS
Robert K. Vincent, Principal Investigator [1972] 1 p Sponsored by NASA
(E72-10085; NASA-CR-128100; Rept-011229-5-S) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N72-31366*# Mississippi State Univ., State College. Coll. of Engineering.
STUDY OF THE APPLICATION OF REMOTE SENSING DATA TO LAND USE PLANNING ON THE MISSISSIPPI GULF COAST Progress Report, period ending 30 Sep. 1972
Frank Ingels, Principal Investigator 1 Oct. 1972 2 p
(Contract NAS5-21817)
(E72-10087; NASA-CR-128102) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N72-31367*# Geological Survey, Washington, D.C.
ANALYSIS STUDY OF MULTISPECTRAL DATA, ERTS-A, FROM AN AREA IN WEST PAKISTAN Progress Report, 1 Jul. - 31 Aug. 1972
Robert G. Schmidt, Principal Investigator 1 Sep. 1972 2 p Sponsored by NASA
(E72-10102; NASA-CR-128161) Avail: NTIS HC $3.00 CSCL 08I

There are no author-identified significant results in this report.

N72-31368*# Lamont-Doherty Geological Observatory, Palisades, N.Y.
PLATE CONVERGENCE, TRANSCURRENT FAULTS AND INTERNAL DEFORMATION ADJACENT TO SOUTHEAST ASIA AND THE WESTERN PACIFIC
Thomas J. Fitch 15 Dec. 1971 75 p refs
(Grant NGR-33-008-146)
(NASA-CR-122519) Avail: NTIS HC $5.75 CSCL 08E

A model for oblique convergence between plates of lithosphere is proposed in which at least a fraction of slip parallel to the plate margin results in transcurrent movements on a nearly vertical fault which is located on the continental side of a zone of plate consumption. In an extreme case of complete decoupling only the component of slip normal to the plate margin can be inferred from underthrusting. Recent movements in the western Sunda region provide the most convincing evidence for decoupling of slip, which in this region is thought to be oblique to the plate margin. A speculative model for convergence along the margins of the Philippine Sea is constructed from an inferred direction of oblique slip in the Philippine region. This model requires that the triple point formed by the junction of the Japanese and Izu-Bonin trenches and the Nankai trough migrate along the Sagami trough. Author

N72-31369*# Colorado School of Mines, Golden. Dept. of Geology.
APPLICATIONS OF REMOTE SENSOR DATA TO GEOLOGIC AND ECONOMIC ANALYSIS ON THE BONANZA TEST SITE, COLORADO Semiannual Progress Report, 1 Oct. - 31 Mar. 1972
Robert G. Reeves, comp. May 1972 121 p refs Prepared in cooperation with Martin Marietta Corp., Denver, Colo.

(Grant NGL-06-001-015)
(NASA-CR-128062; Rept-72-4) Avail: NTIS HC $8.25 CSCL 08G

Recent studies conducted in the Bonanza Test Site, Colorado, area indicated that: (1) more geologic structural information is available from remote sensing data than from conventional techniques; (2) greater accuracy results from using remote sensing data; (3) all major structural features were detected; (4) of all structural interpretations, about 75% were correct; and (5) interpretation of remote sensing data will not supplant field work, but it enables field work to be done much more efficiently. Author

N72-31370*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
BASIC RESEARCH AND DATA ANALYSIS FOR THE NATIONAL GEODETIC SATELLITE PROGRAM AND FOR THE EARTH SURVEYS PROGRAM Semiannual Status Report, Jan. - Jun. 1972
Jul. 1972 131 p refs
(Grant NGL-36-008-093; OSURF Proj. 2514)
(NASA-CR-128113; SASR-10) Avail: NTIS HC $8.75 CSCL 03B

Current research is reported on precise and accurate descriptions of the earth's surface and gravitational field and on time variations of geophysical parameters. A new computer program was written in connection with the adjustment of the BC-4 worldwide geometric satellite triangulation net. The possibility that an increment to accuracy could be transferred from a super-control net to the basic geodetic (first-order triangulation) was investigated. Coordinates of the NA9 solution were computed and were transformed to the NAD datum, based on GEOS 1 observations. Normal equations from observational data of several different systems and constraint equations were added and a single solution was obtained for the combined systems. Transformation parameters with constraints were determined, and the impact of computers on surveying and mapping is discussed. N.E.N.

N72-31371# National Physical Lab., New Delhi (India). Radio Science Div.
THEORETICAL MODELS OF THE LOWER IONOSPHERE
A. P. Mitra and D. K. Chakrabarty Nov. 1971 26 p refs Presented at Conf. on Theoret. Ionospheric Models, University Park, Pa., 14-16 Jun. 1971
(RSD-70) Avail: NTIS HC $3.50

A method was developed to provide theoretical D region models that are consistent with (1) observed profiles, and (2) currently accepted ion and neutral chemistry in the D region. Profiles are given for mid-latitude conditions for minimum solar activity as a function of diurnal time. Corresponding positive ion profiles are also given. Author

N72-31372# Forest Economics Research Inst., Ottawa (Ontario).
THE ECONOMICS OF REMOTE SENSING OF FOREST LAND
H. Rae Grinnell and Michael S. Conway [1971] 13 p refs
Avail: NTIS HC $3.00

The output of remote sensing systems is discussed in terms of economics, early development, and effective use in Canada. Opportunities to increase benefits from current systems depend on clear objectives for the multiple use of a limited number of image resolutions derived at specific time intervals. The fractionated incomplete photo coverage of Canada and the low unit cost of standardized scales are suggested as ample reasons to bring about some rationalization of the current multi-view approach to resource surveying in Canada. Author

N72-31373# Canadian Aeronautics and Space Inst., Toronto (Ontario).
CANADA'S ROLE IN REMOTE SENSING
15 Mar. 1971 18 p
Avail: NTIS HC $3.00

The implications for Canada of the technology of remote sensing from Earth Resources Technology Satellites and aircraft are discussed. Brief analyses of sovereignty problems, Canada's proposed role in remote sensing, and the potential benefits are included. F.O.S.

N72-31374# Forest Management Inst., Ottawa (Ontario).
AIR PHOTO COVERAGE FOR CANADIAN FORESTRY
Murray G. Bowen Dec. 1971 85 p refs Original contains color illustrations
(FMR-X-38) Avail: NTIS HC $6.25

The report, based upon recent information obtained from Canada's National Air Photo Library and the Provinces of New Brunswick, Quebec, Ontario, Alberta and British Columbia, shows by means of 66 maps, by province and territory, the location and extent of the air photo coverage of Canada obtained during the period 1966 to October 1970, which may be useful to forestry. Federal and provincial coverage is shown separately and while no private coverage is shown, advice is given, as on governmental sources, on the sources of copies of private air photos. A brief history, together with references, of Canada's air photo coverage, is also included. Author

N72-31375# Gregory (Alan F.), Ottawa (Ontario).
WHAT DO WE MEAN BY REMOTE SENSING?
Alan F. Gregory 1972 5 p refs Presented at 1st Can. Symp. on Remote Sensing, Ottawa, Feb. 1972
Avail: NTIS HC $3.00

A formal division is proposed between remote sensing as a means of collecting data, and the information system that attaches significance to them. Further delineation, based on physical principles, results in the following definition: Remote sensing denotes the aerospace practices of surveying the ultraviolet, visible, infrared and microwave radiations emitted and reflected from the surface of the earth (or any plant). Author

N72-31376# Canada Centre for Remote Sensing, Ottawa (Ontario).
A REVIEW OF SATELLITE AND AIRCRAFT REMOTE SENSING INSTRUMENTATION
J. MacDowall 7 Feb. 1972 67 p Presented at the Can. Symp. on Remote Sensing, Ottawa, 7 Feb. 1972
Avail: NTIS HC $5.50

A review is presented of earth resource sensors which are available or under development. Information on sensor characteristics is given so that the user can select the most appropriate available system for use. Developments in Canada are introduced indicating fruitful areas for instrumentation development and techniques with particular promise. Author

N72-31377# Department of Energy, Mines and Resources, Ottawa (Ontario). Program Planning Office.
CF-100 HIGH ALTITUDE REMOTE SENSING PROJECT
F. A. Godby [1971] 7 p
Avail: NTIS HC $3.00

This project was initiated for the purposes of: (1) investigating the potential of high altitude, small scale imagery for mapping and natural resources application, and (2) obtaining simulated spacecraft imagery. The vehicle used is a CF-100 aircraft, outfitted as a camera platform to meet the experimental and test requirements of the Department of National Defence. The first flight was conducted on 19 May 1970 over Lake Ontario. Author

N72-31378# Department of Energy, Mines and Resources, Ottawa (Ontario). Program Planning Office.
THE NASA ERTS SYSTEM AND POTENTIAL COVERAGE OF CANADA
R. O. Chipman [1971] 6 p
Avail: NTIS HC $3.00

Plans to orbit an Earth Resources Technology Satellite (ERTS) to provide high resolution images of the earth on a repetitive basis are discussed. The launching of the first satellite, ERTS-A, is scheduled for March of 1972, to be followed about one year later by an almost identical ERTS-B. The satellite will be placed in a circular, near polar sun-synchronous orbit at an altitude of 910 km and will carry four sensors, three return beam vidicon (RBV) cameras, identical except for spectral filters, and a four-channel multispectral scanner, all of which will cover the same 185 km wide swath along the ground track, the vidicons taking a series of snapshots and the scanner scanning continuously. The ground resolution is expected to be 80 to 150 m per line pair. The imagery can be recorded in the satellite for later transmission or transmitted directly to a ground receiving station where it will be recorded and sent to a central data handling center to be transformed into hard copy (photography). Corrections to make the imagery conform geometrically with existing maps will then be made and the images, in color or black and white, will be sent directly to users or to specialized data interpretation centres. The satellite will also have the capability of relaying data from remote automatic ground platforms, such as stream or tide gauges, etc., to the receiving station on a daily basis. Author

N72-31379# Forest Management Inst., Ottawa (Ontario).
A NEW APPROACH TO THE DESCRIPTION OF THE FOREST REGIONS OF CANADA USING 1:160,000 COLOR INFRARED AERIAL PHOTOGRAPHY
U. Nielsen and J. M. Wightman Aug. 1971 30 p refs
(FMR-X-35) Avail: NTIS HC $3.50

Color infrared aerial photography at a scale of 1:160,000, provided suitable images for the delineation of forest sections based on a classification criteria used by Rowe in Forest Regions of Canada. This is demonstrated by sample stereo pairs and mosaics included in the report. It is concluded that ultra-small scale aerial photography, of the quality studied, provides enough information to undertake even more detailed forest typing than outlined here. Author

N72-31380# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, APRIL 1972 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, APRIL 1972]
Apr. 1972 44 p In GERMAN and ENGLISH
(Rept-310-F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere over Freiburg, Germany during April 1972. The data include charts of median values for the E and F regions, MUF(3000)F2, M(3000)F2, h'F2, pf2, foF1, MUF(3000) F1, h'F, foE FoE2, h'E, foEs, h'Es, Type Es, foT, and fmin. Author

N72-31381# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, MAY 1972 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG, FREIBURG, URSI-CODE 131, MAI 1972]
May 1972 44 p In GERMAN and ENGLISH
(Rept-311-F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere over Freiburg, Germany during May 1972. The data include charts of median values for the E and F regions, MUF(3000)F2, M(3000)F2, h'F2, hpF2, foF1, MUF(3000)F1, h'F, foE, FoE2, h'E, foEs, h'Es, Type Es, foT, and fmin. Author

N72-31382# Manitoba Ad Hoc Committee on Resource Satellites and Remote Airborne Sensing, Winnipeg.
EVALUATION OF 1971 REMOTE SENSING ACTIVITY IN MANITOBA
Charles Tarnocai 22 Dec. 1971 63 p refs
Avail: NTIS HC $5.25

The Canadian Federal Agriculture and Geography working group on resource satellite and airborne remote sensing selected a number of ground truth test areas in various regions of Canada. In Manitoba the following three test areas were chosen: the Neepawa area, the Thompson-The Pas area, and the Churchill area. In addition to these, the Carroll Lake test area was added in 1971. It is anticipated that these sites will provide sample areas for collecting ground truth information relating to imagery from resource satellites, such as the ERTS A and B. To compliment the resource satellite imagery to be obtained beginning in 1972, an airborne remote sensing program was started by the Remote Sensing Centre. Four provincial remote sensing working groups were established under the broad headings of geology, land, vegetation, and water in the spring of 1971. These working groups, with assistance from the Manitoba ad hoc Committee, organized the ground truth investigations, formulated photo specifications, and in the fall, when the imagery became available, started interpretation of the data. Author

N72-31383*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OBSERVATIONS OF PROTON SPECTRA (1.0 LESS THAN OR EQUAL TO PROTON ENERGY LESS THAN OR EQUAL TO 300 keV) AND PITCH ANGLE DISTRIBUTIONS AT THE PLASMAPAUSE
D. J. Williams (NOAA), T. A. Fritz (NOAA), and A. Konradi Boulder, Colo. NOAA. Space Environment Lab. Jun. 1972 21 p refs
(NASA Order S-50028)
(NASA-TM-X-68743; NOAA-TM-ERL-SEL-21) Avail: NTIS HC $3.25 CSCL 04A

Detailed proton spectral and pitch angle distribution observations were obtained from two proton detectors and a fluxgate magnetometer flown on Small Scientific Satellite A (Explorer 45). The data of interest are from orbit 99 in-bound occurring on 17 December 1971, some 8 hours prior to the sudden commencement of a magnetic storm. The data are consistent with the initiation of ion cyclotron instability when certain requirements are met. These criteria are met initially at the altitude at which the sudden intensity decrease occurs. However, after the initiation of the instability, the linear theory is unable to explain the further evolution of intensities, pitch angle distributions, and energy spectra of the ring current particles. Author

N72-31384*# National Aeronautics and Space Administration, Washington, D.C.
PHYSICS OF THE SPACE ENVIRONMENT
R. E. Smith, ed. and S. T. Wu, ed. 1972 176 p refs Colloq. held at Huntsville, Ala., 1970 - 1971
(NASA-SP-305) Avail: NTIS HC $3.00 CSCL 03B

Colloquium papers are presented on the physics of the upper atmosphere and on solar flare forecasting. The topics include atmospheric heating, ionospheric currents, atmospheric structure, auroral red arcs, gravity waves, atmospheric composition, and atmospheric chemistry. For individual titles, see N72-31385 through N72-31393.

N72-31385* Colorado Univ., Boulder. Dept. of Astro Geophysics.
TRANSIENT HEATING IN THE UPPER ATMOSPHERE
Gary E. Thomas *In* NASA, Washington Phys. of the Space Environment 1972 p 3-23 refs (For availability see N72-31384 22-13)
CSCL 04A

The time-dependent response of the upper atmosphere to transient heat sources is considered. The basic problem is that of heating a compressible, heat-conducting fluid, which is described in the one-dimensional case by an analytic solution. Comparisons with satellite drag data of such first-order solutions are shown to be useful in determining energy requirements and in determining some constraints on the spatial distribution of the heating. Recent OGO-6 mass spectrometer and interferometric temperature

measurements show that atmospheric disturbances during geomagnetic storms are much more prominent in the auroral zones. These results suggest that joule dissipation of auroral currents are important contributors to orbital perturbations of satellites. Author

N72-31386* La Trobe Univ., Bundoora (Australia). Div. of Space Physics.
DISSIPATION OF ELECTRIC FIELDS IN THE IONOSPHERE
K. D. Cole *In* NASA, Washington Phys. of the Space Environment 1972 p 25-40 refs (For availability see N72-31384 22-13)
CSCL 04A

The heating and movement of the upper atmosphere at ionospheric levels in response to electric currents are discussed. Joule dissipation, generation of winds, and pressure gradients are significant factors in the energetics of the ionospheric electric currents flowing during magnetic storms and also of the Sq current system. Author

N72-31387* Smithsonian Astrophysical Observatory, Cambridge, Mass.
STRUCTURE AND VARIATIONS OF THE HETEROSPHERE
L. G. Jacchia *In* NASA, Washington Phys. of the Space Environment 1972 p 41-43 (For availability see N72-31384 22-13)
(Grant NGR-09-015-002)
CSCL 04A

Atmospheric composition is kept almost homogeneous to a height of approximately 90 km (the homosphere) by mixing; above 100 km (the heterosphere), diffusive separation of the atmospheric constituents occurs. The heterosphere is dominated by two energy sources: solar extreme ultraviolet radiation and the solar wind. Many large variations are observed in this region and they can all be related, directly or indirectly, to variations in the intrinsic intensity of these two sources and to variations in the location of the sources relative to the observer. Atmospheric models can be successfully constructed in which the temperature and density variations are empirically related to solar and geomagnetic parameters. Some of the more recent findings concerning the structure and variations in the heterosphere are presented. Author

N72-31388* National Center for Atmospheric Research, Boulder, Colo.
THE STABLE AURORAL RED ARC OF OCTOBER 31 - NOVEMBER 1, 1968 AND ITS INTERACTION WITH THE NEUTRAL ATMOSPHERE
R. G. Roble *In* NASA, Washington Phys. of the Space Environment 1972 p 45-69 refs Sponsored by NSF (For availability see N72-31384 22-13)
CSCL 04A

Satellite observations of electron temperature and the topside electron density structure are used to calculate the red arc according to the thermal conduction model. In this model, energy from the magnetosphere flows in the electron gas along geomagnetic field lines into the ionosphere. This energy heats the ambient F-region electrons sufficiently to excite the oxygen atoms to the O I(1D) level by collisional impact giving rise to the 6300 A emission characteristic of the arc. For the 31 October/1 November 1968 red arc, the calculated emission rate, geographical position, and horizontal extent of the red arc are in agreement with the photometric data obtained by airglow observatories. Almost all of the energy conducted into the red arc is ultimately transferred to the neutral gas through elastic and inelastic collisions. This energy drives a large thermal cell and the circulation extends the influence of the arc thousands of kilometers beyond the region of direct heat input. The calculated neutral gas temperature response to electron heating within the arc is small. Author

N72-31389* Chicago Univ., Ill.
SOME ASPECTS OF ATMOSPHERE WAVES IN REALISTIC ATMOSPHERES
Richard S. Lindzen *In* NASA, Washington Phys. of the Space Environment 1972 p 71-90 refs (For availability see N72-31384 22-13)
(Grant NSF GA-25904)
CSCL 04A

Atmospheric tides travelling from the mesosphere into the upper thermosphere are discussed. As a preliminary, an elementary discussion of internal gravity waves is presented. Tides excited by the absorption of extreme ultraviolet radiation within the thermosphere are described also. Theory suggests a much larger semidiurnal oscillation in the thermosphere than is observed. Author

N72-31390* Florida Univ., Gainesville. Dept. of Physics and Astronomy.
UPPER ATMOSPHERIC SPECTROSCOPY
A. E. S. Green, S. S. Prasad, and L. R. Peterson *In* NASA, Washington Phys. of the Space Environment 1972 p 91-127 refs (For availability see N72-31384 22-13)
(Contract AT(40)-13798; Grant NGR-10-005-008)
CSCL 04A

Atomic physics is so intimately entwined with planetary aeronomy that progress in this geophysical-astronomical discipline is dependent in large measure upon progress in certain phases of atomic physics. The interdependence is illustrated by a discussion of photon, electron, and proton stimulation of the dayglow and the aurora. Calculations are given for the excitation of various states in N2, O2, and O as a result of electron energy degradation, assuming a gas mixture appropriate to 120 km. Emphasis is given to the O2(a 1 Delta g) 1.27 micron emission and to the low energy region in areas where many competing mechanisms enhance or inhibit certain spectral emissions. Author

N72-31391* Minnesota Univ., Minneapolis. School of Physics and Astronomy.
THE COMPOSITION OF THE UPPER ATMOSPHERE
Alfred O. Nier *In* NASA, Washington Phys. of the Space Environment 1972 p 129-145 refs (For availability see N72-31384 22-13)
CSCL 04A

Miniature mass spectrometers were developed and were carried on sounding rockets to determine the composition of the upper atmosphere. Techniques have been developed that accurately correct for the velocity and spin of the moving vehicle. Above 120 km N2, O2, and Ar appear to be in diffusive equilibrium. Most He concentration measurements show a more rapid decline with altitude than predicted by diffusive equilibrium. Because of the highly reactive nature of atomic oxygen, measurements of this species by mass spectrometry are low by an unknown factor. Author

N72-31392* Florida State Univ., Tallahassee.
CHEMISTRY OF THE UPPER ATMOSPHERE AND THE ROLE OF TRANSPORT PROCESSES
Richard A. Craig *In* NASA, Washington Phys. of the Space Environment 1972 p 147-155 refs (For availability see N72-31384 22-13)
CSCL 04A

The important chemical reaction affecting the neutral composition of the upper stratosphere, mesosphere, and lower thermosphere is discussed. The role of atmospheric transport processes is emphasized and the problem of taking these into account is elucidated. Author

N72-31393* Air Force Systems Command, Bedford, Mass. Space Physics Lab.
THE FLARE FORECASTING FIASCO: IS EVERYBODY LOOKING AT THE SAME SUN? c29

Frederick W. Ward, Jr. *In* NASA, Washington Phys. of the Space Environment 1972 p 157-171 (For availability see N72-31384 22-13)
CSCL 03B

The passionate dream of the oppressed solar flare forecaster is the scientific discovery of the cause, the energy source, and the observable antecedent conditions for the solar flare. This tunnel vision has had a profound and deleterious effect on the state-of-the-art. It has diverted attention from many promising approaches and relegated them to limbo. More importantly, it has actually inhibited the scientific search for the underlying physical mechanisms. Examples of neglected aspects of the problem cover the entire range from observing techniques and equipment to the availability and accuracy of the archived scientific data. A cursory inspection of this data leads to an obvious conclusion: there are at least two suns up there. Author

N72-31394*# California Univ., Los Angeles. Plasma Physics Group.
MAGNETOSPHERIC ELECTRONS
F. V. Coroniti and R. M. Thorne Jul. 1972 32 p refs Submitted for publication
(Grants NGR-05-007-190; NSF GA-280; NSF GA-34148)
(NASA-CR-122465; PPG-123) Avail: NTIS HC $3.75 CSCL 03B

Coupling of source, transport, and sink processes produces a fairly accurate model for the macroscopic structure and dynamics of magnetospheric electrons. Auroral electrons are controlled by convective transport from a plasma sheet source coupled with a precipitation loss due to whistler and electrostatic plasma turbulence. Outer and inner zone electrons are governed by radial diffusion transport from convection and acceleration sources external to the plasmapause and by parasitic precipitation losses arising from cyclotron and Landau interactions with whistler and ion cyclotron turbulence. Author

N72-31395*# Lamont-Doherty Geological Observatory, Palisades, N.Y.
MECHANISM OF UNDERTHRUSTING IN SOUTHWEST JAPAN: A MODEL OF CONVERGENT PLATE INTERACTIONS
Thomas J. Fitch and Christopher H. Scholz Jul. 1971 98 p refs
(Grant NGR-33-008-146)
(NASA-CR-122521) Avail: NTIS HC $7.00 CSCL 08K

An elastic rebound mechanism consistent with underthrusting at the time of the magnitude 8.2 Nankaido earthquake of 21 December 1946 accounts for a reversal in sense between seismic and preseismic changes in elevation throughout a large portion of southwest Japan. It is shown that the seismic movements during the earthquake were generated by slip on a complex thrust fault that is inferred to intersect the surface near the base of the continental slope. The preseismic deformation is explained by strain accumulation equivalent to a virtual dislocation with the same orientation as the fault surface but a sense opposite to that of the real dislocation that occurred at the time of the earthquake. Adjustments by slip along the fault surface and extensions of that surface can account for postseismic movements. Author

N72-31396# Academy of Sciences (USSR), Moscow.
HYDRODYNAMIC MODEL OF THE EVOLUTION OF THE EARTH
Ye. G. Markaryan and V. P. Myasnikov 1972 28 p refs In RUSSIAN
Avail: NTIS HC $3.50

A mathematical model of the evolution of the earth is presented. An equation is given for the evolution of spherically symmetric components of geophysical fields. The evolution of chemical composition, convective heat transfer, mass distribution in the body of a planet, and convection are also considered.
Transl. by K.P.D.

N72-31397*# California Univ., Los Angeles. Dept. of Physics.
A UNIFIED THEORY OF STABLE AURORAL RED ARC FORMATION AT THE PLASMAPAUSE
John M. Cornwall, F. V. Coroniti, and R. M. Thorne Nov. 1970 50 p refs
(Grant NGR-05-007-190; Contract F04701-68-c-0200)
(NASA-CR-122473; R-82) Avail: NTIS HC $4.50 CSCL 03B

A theory is proposed that SAR-arcs are generated at the plasmapause as a consequence of the turbulent dissipation of ring current energy. During the recovery phase of a geomagnetic storm, the plasmapause expands outward into the symmetric ring current. When the cold plasma densities reach about 100/cu cm, ring current protons become unstable and generate intense ion cyclotron wave turbulence in a narrow region 1/2 earth radius wide (just inside the plasmapause). Approximately one-half of the ring current energy is dissipated into wave turbulence which in turn is absorbed through a Landau resonant interaction with plasma spheric electrons. The combined thermal heat flux to the ionosphere due to Landau absorption of the wave energy and proton-electron Coulomb dissipation is sufficient to drive SAR-arcs at the observed intensities. It is predicted that the arcs should be localized to a narrow latitudinal range just within the stormtime plasmapause. They should occur at all local times and persist for the 10 to 20 hour duration of the plasma-pause expansion. Author

N72-31398*# California Univ., Los Angeles. Plasma Physics Group.
RELATIVISTIC ELECTRON PRECIPITATION DURING MAGNETIC STORM MAIN PHASE
R. M. Thorne and C. F. Kennel Nov. 1970 22 p refs
(Grant NGR-05-007-190)
(NASA-CR-122472; R-81) Avail: NTIS HC $3.25 CSCL 03B

Relativistic electrons can have cyclotron resonances with electromagnetic cyclotron waves. The resonant energy is generally well above 1 MeV throughout the magnetosphere, but it can fall to 1 MeV just within the plasmapause. This also corresponds to the region where ring current (10 to 50 keV) protons are expected to be strongly unstable. The resulting ion cyclotron wave amplitudes necessary to precipitate ring current protons leads to electron lifetimes near the strong diffusion limit (< 100 sec). Thus, > 1 MeV electrons whose drift orbits intersect the stormtime plasmapause should rapidly be precipitated in the region $3 < L < 5$ during the initial phase of a magnetic storm.
Author

N72-31399# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).
NAUTICAL ALMANAC, 1973
1972 453 p In SPANISH
Avail: NTIS HC $24.75

The nautical almanac for 1973 is presented. The Greenwich hour angle and declination are tabulated hourly for the Sun, Moon, Venus, Mars, Jupiter, and Saturn. The Greenwich hour angle for the first point of Aries is also given hourly. The phases of the moon and charts showing the paths of the lunar and solar eclipses are included. The sideral hour angle and declination for navigational stars are given. Examples illustrating the applications of the almanac are included. Transl. by F.O.S.

N72-31400# Academy of Sciences (USSR), Moscow.
COSMIC DATA. MONTHLY REVIEW NO. 11, NOVEMBER 1971
1972 68 p In RUSSIAN; ENGLISH Summary
Avail: NTIS HC $5.50

The results of observations are presented for geophysical phenomena concerning electric and magnetic field states of the atmosphere (geomagnetic variations, ionospheric, cosmic rays, and telluric currents). Solar activity data are also given. Author

N72-31401# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, JUNE 1972 [IONOSPHAER-

EN-DATEN VERTIKAL-ECHO-LOTUNG: FREIBURG URSI-CODE 131, JUNI 1972]
Jun. 1972 44 p In ENGLISH and GERMAN
(Rept-312-F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere over Freiburg, Germany during June, 1972. The data include charts of median values for the E and F regions, MUF(3000)F2, M(3000)F2, h'F2, hpF2, foF1, MUF(3000)F1, M(3000)F1, h'F, foE, FoE2, h'E, foEs, fbEs, h'Es, Type Es, foT, and fmin. Author

N72-31402# Joint Publications Research Service, Arlington, Va.
UPPER ATMOSPHERE AND SPACE RESEARCH IN THE USSR IN 1969
Yu. I. Yefremov, ed. and R. G. Gruzinova, ed. 3 Sep. 1970 201 p refs Transl. into ENGLISH from the book "Issledovaniya Verkhney Atmosfery i Kosmicheskogo Prostranstva v SSSR v 1969 Godo" Moscow, Nauka Publishing House, 1970 146 p
(JPRS-51308) Avail: NTIS HC $12.25

The development of space research in the USSR in 1969 is considered, including investigation of the moon, the planets, and the sun; investigation of processes and phenomena taking place in space; study of the earth's atmosphere; medical and biological investigations; improvement of the methods of utilizing outer space; and the use of satellites for communication and weather services. Author

N72-31403# Academy of Sciences (USSR), Moscow.
COSMIC DATA. MONTHLY REVIEW NO. 9, SEPTEMBER 1971
1972 52 p In ENGLISH and RUSSIAN
Avail: NTIS HC $4.75

The results of observations are presented for geophysical phenomena concerning electric and magnetic field states of the atmosphere (geomagnetic variations, ionospheric, cosmic rays, and telluric currents). Solar activity data are also given. Author

N72-31404# Academy of Sciences (USSR), Moscow.
COSMIC DATA. MONTHLY REVIEW NO. 12 DECEMBER 1971
1972 54 p In RUSSIAN; ENGLISH summary
Avail: NTIS HC $4.75
For abstract, see N72-31403.

N72-31405# Academy of Sciences (USSR), Moscow.
COSMIC DATA. MONTHLY REVIEW NO. 1 JANUARY 1972
1972 64 p In RUSSIAN; ENGLISH summary
Avail: NTIS HC $5.25
For abstract, see N72-31403.

N72-31406# Cologne Univ. (West Germany). Inst. of Geophysics and Meteorology.
THE IONOSPHERIC ELECTRON CONTENT AND ITS WORLDWIDE LONG-TERM VARIATIONS [DER IONOSPHAERISCHE ELEKTRONENINHALT UND SEINE WELTWEITEN LANGPERIODISCHEN AENDERUNGEN]
A. Ebel May 1971 129 p refs In GERMAN; ENGLISH summary
(MITT-17) Avail: NTIS HC $8.50

Measurements of the ionospheric electron content NT yields valuable information on long-term variations of upper atmospheric layers. An analysis of these variations was carried out by measuring Faraday rotation of radio signals from nonstationary satellites. A special method was applied to evaluate annual and semiannual variations by a combination of graphical interpolation and Fourier analysis. A method has been developed to reduce the data to any given time of day, which is essential when using single values of NT over larger periods. The long term variations of NT are compared with other similar changes in the ionosphere and neutral upper atmosphere. A model is proposed which takes into account circumpolar circulation, and seasonal changes of the upper atmospheric composition are discussed in the light of this model. ESRO

N72-31407# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jan. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, JANVIER 1972]
Jan. 1972 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron components) observations at Dourbes (Belgium) for January 1972 are presented. ESRO

N72-31408# Inter-American Tropical Tuna Commission, La Jolla, Calif.
APPLICATION OF HIGH RESOLUTION INFRARED AND VISUAL DATA TO INVESTIGATE CHANGES IN AND THE RELATIONSHIP BETWEEN SEA SURFACE TEMPERATURES AND CLOUD PATTERNS OVER THE EASTERN TROPICAL PACIFIC Final Report
Merritt R. Stevenson and Forrest R. Miller Apr. 1972 93 p refs
(Contract N62306-71-C-0120)
(AD-743114) Avail: NTIS CSCL 08/10

Results on the application of infrared data from NASA and NOAA satellites for use in the field of fishery oceanography are given. Preliminary results of Project Little Window 2 (LW-2) held in the Gulf of California are discussed. A general review of the numerical techniques used for handling infrared data is given. Methods for photo-digitization of 70 mm and 35 mm filmstrips are also described and examples are given. The importance of surface thermal fronts to biota in general and to the tuna fishery in particular, in the eastern tropical Pacific is discussed. Selected numerical techniques for producing charts that emphasize gradient features are described and examples are given.
Author (GRA)

N72-31409# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
EARTH'S PARTICLES AND FIELDS, 1971 Final Report
Billy M. McCormac, John E. Evans, A. C. Durney (ESRO, Domeinweg-Noordwijk, Netherlands), and C. R. Chappell Dec. 1971 72 p refs
(Contract DASA01-71-C-0102)
(AD-743104; DNA-2828F) Avail: NTIS CSCL 04/1

Contents: Highlights of particles and fields in the magnetosphere; Magnetospheric structure and processes; Magnetospheric particles; Acceleration and diffusion; Electric fields and plasma convection; Magnetospheric substorms. GRA

N72-31410# Naval Weapons Lab., Dahlgren, Va.
POLE POSITION FOR 1971 BASED ON DOPPLER SATELLITE OBSERVATION
Richard J. Anderle May 1972 98 p refs
(AD-742805; NWL-TR-2734) Avail: NTIS CSCL 08/5

The instantaneous position of the earth's spin axis with respect to the crust has been computed daily since 1969 on the basis of Doppler satellite observations. Improved sets of observing station coordinates and gravity field coefficients obtained in 1970 were used through 1971 yielding pole positions with a standard error of about 0.5 meters for the mean of five days of data. However, for some time periods, a bias of about 0.5 meters also exists between the Doppler pole positions and positions reported by the Bureau International de L'Heure (BIH) based on astronomical data. Spot checks of latitude residuals and pole positions based on recomputed satellite orbits for 1968 and 1969 yielded results consistent with recent data, indicating significant compensation of station coordinate errors by changes in orbit constants. Author (GRA)

N72-31411# Naval Postgraduate School, Monterey, Calif.
THE RELATIONSHIP BETWEEN THE VERTICAL MOTION AT THE TOP OF THE FRICTION LAYER AND THE GEOSTROPHIC VORTICITY AS A FUNCTION OF THE ROSSBY NUMBER M.S. Thesis
Carl Walter Hoffman Mar. 1972 46 p refs
(AD-742922) Avail: NTIS CSCL 04/1

The relationship between vertical motion at the top of the boundary layer, geostrophic vorticity in the boundary layer and divergence in the boundary layer are examined in the study. The equation of motion and the continuity equation are applied to a homogeneous barotropic atmosphere using a numerical model in the study. The solutions reveal that the boundary layer is stable for very large values of Ro in the case of positive vorticity and becomes unstable at Ro 1.0 in the case of negative vorticity. A difference in behavior is found between cases of anticyclonic and cyclonic shear. The magnitude of the vertical velocity is greater and the boundary is thicker for anticyclonic than for cyclonic shear systems of equivalent strength. Author (GRA)

N72-31412# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
EFFECT OF NO(x) ON STRATOSPHERIC OZONE
A. A. Westenberg Mar. 1972 24 p refs
(Contract N00017-72-C-4401)
(AD-742829; APL-TG-1186) Avail: NTIS CSCL 04/1

The chemical reactions of significance in determining the photochemical equilibrium concentration of O3 in the dry stratosphere when NO(x) (i.e., the total of NO and NO2) is present are discussed. The appropriate rate equations are put into compact, nondimensional form for calculating the reduction in O3 caused by NO(x), and numerical solutions are given for a range of parameters likely to cover all cases of practical interest. A strongly catalytic effect of NO(x) in reducing O3 is indicated. Specific calculations for typical atmospheric conditions are presented which show that the inclusion of naturally present NO(x) at a mole fraction of about 10 to the -8th improves considerably the agreement between theoretical and experimental O3 profiles. The possible effects of the artificial addition of NO(x) (as by large-scale SST operations) is considered, and it is emphasized that the relative importance of this is crucially dependent on the amount of NO(x) already present naturally.
Author (GRA)

N72-31413# TRW Systems Group, Redondo Beach, Calif. Theoretical Physics Group.
ANALYTICAL STUDIES OF SCATTERING AND EMISSION BY THE SEA SURFACE Quarterly Status Report, 1 Mar. - 31 May 1972
Richard J. Wagner 1 Jun. 1972 3 p
(Contract N00014-71-C-0240; NR Proj. 387-051)
(AD-743147; TRW-17608-6008-R0-00) Avail: NTIS CSCL 08/3

An appropriate form of the sea surface wave height spectrum is discussed. GFA

N72-31414# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MOTIONS OF TRAILS THROUGH FLUIDS WITH CONSTANT VELOCITY SHEAR
Harry E. Moses 27 Sep. 1971 7 p refs Submitted for publication
(AD-742738; AFCRL-72-0283) Avail: NTIS CSCL 04/1

Smoke trails are used to find winds in the upper atmosphere. In the present paper, the authors study, theoretically, the motion of smoke trails in winds of constant shear in the case of potential, vorticity, and stratified flows. Some general considerations of the motion of smoke trails are also given.
Author (GRA)

N72-31415# Virginia Univ., Charlottesville.
THE APPLICATION OF IMAGE SENSING ARRAYS TO METROLOGY, DETECTION AND INSTRUMENTATION Final Report
Eugene S. McVey, Edward A. Parrish, Jr., and Gerald Cook May 1972 130 p refs
(Contract DAAK02-71-C-0075)
(AD-743233; EE-3314-104-72U; ETL-CR-72-5) Avail: NTIS CSCL 08/2

The report covers the second year of research on what is intended to be a relatively long-term effort devoted to the study of the application of image sensing arrays and related problems. A major portion of the effort has been to further the understanding of applying perturbation to improve performance of sensor arrays. Future work will continue to be concerned with delineating the limits of this technology. It is intended that these techniques shall ultimately be applied to the processing of maps and map information. Author (GRA)

N72-31416# Stanford Research Inst., Menlo Park, Calif.
DNA PROJECT 617 RADAR: FIRST AURORAL ZONE RESULTS Final Report, Jul. - Nov. 1971
Murray J. Baron, Theodore M. Watt, Charles L. Rino, and Juris Petriceks Dec. 1971 160 p refs
(Contract DASA01-70-C-0124; SRI Proj. 8661)
(AD-742523; DNA-2826F) Avail: NTIS CSCL 04/1

The report describes the ionospheric studies performed between July and November 1971 using the DNA Project 617 incoherent-scatter radar. The diurnal and (to some extent) seasonal behavior of the auroral ionosphere has been studied using 24-hour continuous data. Measurements on the auroral E-layer have shown densities as high as 1.8 x 10 to the 12th power el/cc. Other characteristics of the auroral E-layer that have been studied include its thickness, electron-density gradient, production rate, and recombination coefficient. Velocity measurements have been made that show the normal as well as disturbed behavior. Ionization drift velocities as high as 200 m/s have been measured. The latitudinal distribution of ionization over several degrees of magnetic latitude has been observed and on several occasions the position of the northern boundary of the plasma trough has been determined. Also described are cooperative experiments in progress with satellites, the Homer multifrequency auroral radar, and various auroral-zone geophysical measurement programs. Author (GRA)

N72-31417# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
HIGH LATITUDE PHENOMENOLOGY Final Report
B. M. McCormac, J. E. Evans, R. D. Sears, and R. Berg Jun. 1971 63 p refs
(Contract DASA01-71-C-0085)
(AD-742518; LMSC-D179555; DNA-2861F) Avail: NTIS CSCL 04/1

The solar wind furnishes the power for a number of energetic high latitude phenomena. The overall magnetospheric morphology is described. The interaction begins with a description of the solar wind and then leads through the magnetospheric structure. The energetic particle precipitation is described. The sources of the various electron and proton precipitation areas are identified. Much of the plasma and energetic particle behavior is governed by the earth's magnetic field which is described. The plasma and particle populations in the various regions of the magnetosphere are identified. A number of fluctuating phenomena in the magnetosphere are described. Current systems and heat conduction are discussed. GRA

N72-31418# Teledyne Geotechnical, Alexandria, Va.
SEISMIC ARRAY ANALYSIS CENTER Quarterly Technical Summary Report, Jul. - Sep. 1971
William C. Dean 13 Oct. 1971 16 p
(Contract F33657-71-C-0510; ARPA Order 1620)
(AD-742868) Avail: NTIS CSCL 17/10

During July, August, and September 1971, the Detection Processor was operated routinely with the same set of system parameters used during the first quarter of 1971. The necessary FORTRAN software for a preliminary evaluation of the long

period capability of the large array network was completed. The Detection Processor ran routinely. GRA

N72-31419# Texas Instruments, Inc., Dallas. Services Group.
EXTENDED ARRAY EVALUATION PROGRAM Quarterly Report, 1 Jul. - 30 Sep. 1971
Terence W. Harley 15 Oct. 1971 107 p refs
(Contract F33657-71-C-0843; ARPA Order 1714)
(AD-742867; QR-2) Avail: NTIS CSCL 17/10

The second quarterly report discusses work performed under the Extended Evaluation of ALPS, NORSAR, and LPE Data program, work to date in the following areas is discussed: Software upgrades; ALPS evaluation; NORSAR long period evaluation; NORSAR short period evaluation; LPE evaluation. Author (GRA)

N72-31420# Teledyne Geotechnical, Garland, Tex.
OPERATION OF TONTO FOREST SEISMOLOGICAL OBSERVATORY Quarterly Report, 1 Jul. - 30 Sep. 1971
15 Oct. 1971 20 p
(Contract F33657-72-C-0013; ARPA Order 1714; AFTAC Proj. VT-2704)
(AD-742866; TR-71-21; QR-1) Avail: NTIS CSCL 17/10

The report is of the work accomplished on Project VT/2704 from 1 July through 30 September 1971. It describes the operation, evaluation, and improvement of the Tonto Forest Seismological Observatory (TFSO) located near Payson, Arizona, research and test functions carried out at the TFSO, and research and development tasks performed by the Garland, Texas staff using TFSO data. Author (GRA)

N72-31421# Naval Postgraduate School, Monterey, Calif.
COMPRESSIONAL WAVE SPEED AND ABSORPTION MEASUREMENTS IN A SATURATED KAOLINITE-WATER ARTIFICIAL SEDIMENT M.S. Thesis
Charles Allen Martinek Mar. 1972 40 p refs
(AD-742928) Avail: NTIS CSCL 08/10

The absorption coefficient for compressional waves in a water-saturated, kaolinite clay was measured in the frequency range 100 to 150 kHz using a pulse technique with spherically diverging waves. The measurement also permitted determination of the sound speed. For one condition of the clay with a 77% porosity, the sound speed was 1422 m/sec. The absorption coefficient, a, was found to be frequency dependent, satisfying the empirical relationship $a = 0.033\ f$ db/m, f being the frequency in kHz. No dispersion of wave speed with frequency was observed. These results were used together with the results of dynamic shear modulus measurements made with a torsional wave viscoelastometer to calculate the complex Lame constants of a viscoelastic model. Author (GRA)

N72-31422# Naval Postgraduate School, Monterey, Calif.
ADVANCED DESIGN, ALIGNMENT AND CALIBRATION OF AN APPARATUS TO MEASURE THE EFFECTIVE CROSS-SECTION OF MOLECULAR NITROGEN WHEN BOMBARDED BY LOW ENERGY ELECTRONS M.S. Thesis
James David Fontana Dec. 1971 32 p refs
(AD-742925) Avail: NTIS CSCL 07/4

The design and construction of a previously incomplete apparatus was advanced in preparation for measuring the effective cross-sections for forming the B doublet Sigma(u)(+) state of N2(+) and the C triplet Pi(u) state of N2 in the lowest vibrational level when excited by low energy electrons in the 50 to 2,000 eV range. The equipment's electron beam and optical system were aligned and its combined optical, detection and counting system was calibrated to obtain its efficiency in counting photons emitted from the C triplet Pi(u) state decay. Author (GRA)

N72-31423# Naval Postgraduate School, Monterey, Calif.
AN OCEANOGRAPHIC INVESTIGATION OF THERMAL CHANGES IN MONTEREY BAY, CALIFORNIA, SEPTEMBER 1971 - JANUARY 1972 M.S. Thesis
Joseph James McClelland, Jr. Mar. 1972 101 p refs
(AD-743084) Avail: NTIS CSCL 08/10

Nine oceanographic stations in Monterey Bay were occupied on at least weekly intervals from 21 September 1971 through 28 January 1972. During this period the three oceanic seasons described by previous investigators were observed. Measured thermal conditions were compared to previously derived long-term mean values. The magnitude of the short-period thermal fluctuations was comparable to that noted in earlier investigations. The changes in seasonal thermal structure were greater and more rapid than climatology implied. Unusually weak upwelling in August 1971 was followed in October by stronger than normal upwelling. Author (GRA)

N72-31424# Naval Postgraduate School, Monterey, Calif.
VERIFICATION OF FLEET NUMERICAL WEATHER CENTRAL WAVE ANALYSES M.S. Thesis
William Harvey Massicot Mar. 1972 84 p refs
(AD-742946) Avail: NTIS CSCL 08/3

Fleet Numerical Weather Central (FNWC) wave period and height analyses for a selected grid point were verified by comparison with wave conditions recorded by a coastal wave sensor at San Clemente Island, California. Forty-six per cent of the FNWC wave heights were within plus or minus 1 foot of the recorded heights, 75% were within plus or minus 2 feet, and 91% were within plus or minus 4 feet. The FNWC heights were found to be over-six per cent of the FNWC periods were within plus or minus 1 second of the recorded periods, 45% were within plus or minus 2 seconds, 66% were within plus or minus 4 seconds, and 90% were within plus or minus 6 seconds. There was no tendency for FNWC to over or underpredict swell periods, but wind-wave periods were under predicted on the average by five seconds. Author (GRA)

N72-31425# Washington Univ., Seattle.
GREENLAND SEA CURRENTS
Knut Aagaard 1 Jun. 1972 9 p refs
(Contract N00014-67-A-0103-0023; ARPA Order 1783; NR Proj. 307-342)
(AD-742828) Avail: NTIS CSCL 08/3

The Greenland Sea holds a position of unique importance and interest among all the Arctic seas. There are two essentially different reasons for this. One, the northern portion constitutes the major connection of the Arctic Basin with the rest of the world ocean, both in terms of depth and cross-sectional area, and in terms of the actual flow of water. Two, the Greenland Sea (and the Norwegian and Iceland seas, together with which it forms an intricately combined system) is a large, deep, partially ice-covered sea; it is one of the northern hemisphere's primary heat exchangers. The report discusses preliminary plans to measure the currents in the Greenland Sea. GRA

N72-31426# Naval Research Lab., Washington, D.C.
INITIAL CONSTRUCTION AND DEPLOYMENTS OF THE LONG TERM AMBIENT NOISE BUOY
Walter C. Diehl 16 May 1972 22 p
(AD-743887; NRL-7403) Avail: NTIS CSCL 13/10

The Systems Engineering Staff of the NRL Acoustic Division has the requirement to build a long-term, unattended, bottom-anchored buoy for collecting acoustic ambient noise in the deep ocean. With a nucleus of surplus equipment from two buoy projects of the 1960's plus additional equipment designed and built at NRL, seven Ambient Noise Buoys were fabricated. One was designed for investigation in the frequency range of 1 to 10 Hz with four hydrophones, three were designed for the band from 20 to 400 Hz with two hydrophones, and three were cesigned for the band from 20 to 400 Hz with one hydrophone. Author (GRA)

N72-31427# Ohio State Univ., Columbus. Dept. of Geodetic Science.
A STUDY OF THE ALIASING EFFECT IN GRAVITATIONAL

POTENTIAL COEFFICIENTS AS DETERMINED FROM GRAVITY DATA
George A. Desrochers Dec. 1971 82 p refs
(Contract F19628-69-C-0127; AF Proj. 7600)
(AD-742284; DGS-160; AFCRL-72-0002; SR-19) Avail: NTIS CSCL 08/5

The computation of potential coefficients from gravity anomalies has been investigated from two points of view. The first area of investigation concerned the computation of anomalies from a defined set of potential coefficients using evaluations through an integrated procedure and through evaluation at the center of blocks on the surface of the sphere. These anomalies were then substituted into standard summation formulas to test the recovery of the original coefficients. It was found that the original coefficients were recovered better when a center point evaluation was made as opposed to the integrated approach. The second area of study concerned the aliasing effect caused by having gravity data of unequal standard errors in a weighted least squares adjustment. It was found that the aliasing effect alters all potential coefficients of a least squares solution. Using the coefficients found from solutions affected by the aliasing effect, it was also found that the higher degree anomaly information was not absorbed in the lower degree terms.
Author (GRA)

N72-31428# Ohio State Univ., Columbus. Dept. of Geodetic Science.
ACCURACY OF POTENTIAL COEFFICIENT DETERMINATIONS FROM SATELLITE ALTIMETRY AND TERRESTRIAL GRAVITY
Richard H. Rapp Dec. 1971 35 p refs
(Contract F19628-69-C-0127; AF Proj. 7600)
(AD-742285; DGS-166; AFCRL-72-0003; SR-20) Avail: NTIS CSCL 08/5

Satellite altimetry data is treated in this paper as if it gave direct determinations of geoid undulations. These undulations are related to potential coefficients in a model that permits determinations of the potential coefficients in a weighted least squares sense from such data, and in combination with terrestrial gravity data. The accuracy of potential coefficient determinations from various data accuracies and data combinations were investigated. From these accuracies conclusions are drawn on the problem of what is the highest degree potential coefficient that can be found from given data. Author (GRA)

N72-31429# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OBSERVATION OF VLF WHISTLER-MODE WAVES PECULIAR TO THE RADIATION BELT SLOT Technical Report, Apr. 1968 - Jul. 1971
Harry C. Koons and Donald A. McPherson 22 May 1972 24 p refs
(Contract F04701-71-C-0172)
(AD-743888; TR-0172(9220-01)-1; SAMSO-TR-72-110) Avail: NTIS CSCL 04/1

VLF emissions between 3.9 and 10.4 kHz are observed at high altitudes in the slot region (L approximately 2.5 to 3.6) by a receiver aboard spacecraft OV1-14 (1968-26B). The maximum spectral intensities of 1.1 microgamma/(Hz to the 1/2 power) and 2.8 microvolt/(Hz to the 1/2 power) on the magnetic and electric antennas, respectively, occur in the 5.6 kHz channel. The waves can resonantly interact with energetic electrons above approximately 50 keV at L = 2.5, and the measured wave intensities are ample to account for the observed lifetimes of medium energy electrons in the slot region. Author (GRA)

N72-31430# Naval Oceanographic Office, Washington, D.C.
METHODS OF COLLECTION AND INVESTIGATION OF SUSPENSIONS FOR GEOLOGICAL PURPOSES
A. P. Lisitsyn 1972 45 p refs Transl. into ENGLISH from Tr. Inst. Okeanol. Akad. Nauk SSSR (Moscow), v. 19, 1956 p 204-231
(AD-742316; NOO-Trans-457) Avail: NTIS CSCL 08/10

Various methods used in the collection and analysis of suspensions in ocean water are analyzed. Both quantitative and qualitative investigations and the appraisal of data, by using optical sedimentation and filtration methods are discussed. In addition, laboratorial studies in the quantitative distribution and qualitative composition of suspensions are evaluated. The methods used by Soviet oceanographers are compared with those of foreign oceanographers, pointing out their advantages and defects in dealing with the samples obtained in surface and bottom waters. Author (GRA)

N72-31431# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A HIGH RESOLUTION N2 ABSORPTION STUDY FROM 730 TO 980 A Technical Report, Apr. 1968 - Dec. 1970
Virginia L. Carter 22 May 1972 46 p refs
(Contract F04701-71-C-0172)
(AD-743889; TR-0172(9260-01)-11) Avail: NTIS CSCL 07/4

The absorption spectrum of N2 obtained photoelectrically at a bandwidth of 0.04 A from 730 to 980 A is presented and compared to earlier, broader band measurements. At wavelengths longer than the ionization edge at 796 A the peak absorption cross sections (and consequently band oscillator strengths) show a highly variable dependence on the number density of absorbing molecules in the light path, which is caused by saturation and bandwidth effects. The results of an attempt to obtain band oscillator strengths in the limit at low column numbers (10 to the 14th power molecules/sq cm) are given. Absolute values for a set of lower limits on the cross sections are given, the structure is identified, and results are compared to those of Cook and Metzger, Huffman et al., and Cook and Ogawa. Optical oscillator strengths are compared to those of Lawrence et al. for the four bands in the interval from 958 to 972 A. Author (GRA)

N72-31432# Naval Research Lab., Washington, D.C. Electromagnetic Scattering Branch.
OPTICAL ANALYSIS FOR THE 1971 ARPA TOWER EXPERIMENT
Denzil Stilwell, Jr. 12 May 1972 48 p refs
(ARPA Order 1907; ARPA Proj. 1E20)
(AD-742334; NRL-7445) Avail: NTIS CSCL 08/3

During the months of September and October 1971, the Naval Research Laboratory performed optical measurements at the Naval Undersea Research and Development Center tower off Mission Bay near San Diego, California. The optical measurements consisted of oblique photographs and wide-angle photography from which the ocean spectrum was analyzed as a function of time using the Sea Photo Analysis (SPA) technique. In conjunction with measurements being made simultaneously by other investigators, an attempt was made to experimentally determine the interaction of internal waves and wind-driven surface waves. This report discusses the results of the optical analysis of the sea photographs taken at 15-s intervals. The results show temporal variations of the spectral amplitude in the range of wavelengths from about 3 cm to 1 m. These temporal variations exhibit changes as large as 15 db on occasion. Because of the superposition of many effects, such as tides, magnitude and direction variations of the wind, internal-wave amplitude, contamination; no unique signature was deduced for the interaction of internal and surface waves. There is evidence for a mild frequency dependence of the interaction. Author (GRA)

N72-31433# Naval Postgraduate School, Monterey, Calif.
THE GEOLOGY OF CARMEL BAY, CALIFORNIA M.S. Thesis
John Page Simpson, III Mar. 1972 73 p refs
(AD-742919) Avail: NTIS CSCL 08/10

Data obtained from rock and sediment samples collected in Carmel Bay were coordinated with seismic and bathymetric information to produce the first geologic map of the area showing the terrestrial geology extended into the bay itself. The map shows a large underwater area of possible contact

metamorphism which serves as the source rock for the heavy minerals found along the local beaches. A previously undescribed granodiorite boulder conglomerate was found resting unconformably on the Paleocene Carmelo Series along the shores of Stillwater Cove. The conglomerate is unlike anything else seen in the area, but it is thought to be associated with the Temblor Formation of Miocene age. Seismic data assisted in locating sediment pockets within the bay. Author (GRA)

N72-31434# Philco-Ford Corp., Billings, Mont. Communications and Technical Services Div.
MONTANA LARGE APERTURE SEISMIC ARRAY Quarterly Technical Report, 1 Jun. - 31 Aug. 1971
R. E. Matkins 15 Sep. 1971 66 p refs
(AFTAC Proj. VT/1708)
(AD-742870; TR-2039-71-10; QTR-3) Avail: NTIS CSCL 17/8

The report relates the technical activity associated with the operation, maintenance, and improvement of the Montana Large Aperture Seismic Array (LASA) for the period 1 June - 31 August 1971. Array equipment performance statistics and measurements are indicated. Adoption of a new tolerance for the channel sensitivities of the short and long-period seismographs is discussed. New computer programs prepared for automatic array maintenance and monitoring are identified. A description of the seismograph film recording operation for the Seismic Data Laboratory is given. Statistics relating to the operation and maintenance of the array and data center equipment and land facilities support are provided.
Author (GRA)

N72-31435# Kansas Univ., Lawrence. Center for Research.
PROJECT THEMIS: A CENTER FOR REMOTE SENSING Semiannual Technical Report, Sep. 1971 - Mar. 1972
F. T. Ulaby, comp. Mar. 1972 58 p refs
(Contract DAAK02-68-C-0089; Proj. Themis)
(AD-743234; CRES-TR-133-28; ETL-CR-72-4; SATR-9) Avail: NTIS CSCL 17/9

The report summarizes the technical progress under the subject contract on a broad interdisciplinary effort for the improvement of user utility of remotely sensed data. This effort involves theoretical work, sensor development, processing and display, and data analysis for specific user application. A number of technical reports and memoranda describing work underway are attached. Author (GRA)

N72-31436# Teledyne Geotechnical, Alexandria, Va.
SEISMIC ARRAY ANALYSIS CENTER Quarterly Technical Summary Report, Jan. - Mar. 1972
W. C. Dean 26 Apr. 1972 13 p
(Contract F33657-72-C-0471; ARPA Order 1620; AFTAC Proj. VT/2709)
(AD-743070) Avail: NTIS CSCL 17/10

The report discusses the following activities during the reporting period: Operations, SP network evaluation, LP processing, SAAC reports for project number 1709, and Documentation and programming. GRA

N72-31437# Stanford Univ., Calif. Electronics Labs.
DIRECTION FINDING ON WHISTLERS AND RELATED VLF SIGNALS
Michael D. Cousins May 1972 201 p refs
(Contract N00014-67-A-0112-0012)
(AD-742776; SU-SEL-72-013; TR-3432-2) Avail: NTIS CSCL 04/1

The direction of arrival of whistlers and related VLF signals has been measured by a new technique. This technique consists of applying an already existing theory (the 'four-parameter method') to data collected by a novel measurement procedure. Measurements of signals induced in orthogonal loop antennas and a vertical monopole located at a single site provide the necessary data. The four-parameter theory relates the loop and vertical voltages, taking into account both amplitudes and phases so that polarization error may be eliminated. The technique can be shown equal or superior in accuracy to any other VLF direction-finding scheme in current use, such as the standard crossed-loops-and-goniometer technique. Author (GRA)

N72-31438# Naval Research Lab., Washington, D.C.
THEORY AND COMPUTER SIMULATION OF WHISTLER TURBULENCE AND VELOCITY SPACE DIFFUSION IN THE MAGNETOSPHERIC PLASMA Interim Report
Sidney L. Ossakow, Edward Ott, and Irving Haber Apr. 1972 43 p refs
(AD-742757; NRL-MR-2432) Avail: NTIS CSCL 04/1

The nonlinear development of unstable whistler waves and their interaction with electrons in an anisotropic, collisionless, magnetospheric-type plasma is investigated by theory and computer simulation experiments. A two component plasma is considered; a hot electron Maxwellian component with 60 degree loss cone is superimposed on a cold isotropic electron background. The linear and quasi-linear theory is developed and quasilinear theory is used to obtain equations for the temporal evolution of the parallel and perpendicular energy for the hot and cold plasma components. The computer code follows the nonrelativistic dynamics of a large number of charges in their self-consistent electromagnetic fields. Three velocity and one spatial dimension are used. The simulation automatically includes energy as well as pitch angle diffusion. Author (GRA)

N72-31439# Pittsburgh Univ., Pa. Atmospheric Sciences Inst.
ATOMIC AND MOLECULAR PROCESSES IN ATMOSPHERIC ENVIRONMENTS Technical Progress Summary Report 1 Nov. 1971 - 28 Apr. 1972
M. A. Biondi 28 Apr. 1972 39 p refs
(Contract DA-31-124-ARO(D)-440; ARPA Order 826)
(AD-742721; AROD-6563-42-P; PR-12) Avail: NTIS CSCL 04/1

Brief research summaries are given for the following topics: Radiative properties of simple atoms and molecules for optical discrimination studies; Dissociative excitation of CO(A singlet Pi) by electron impact on CO2; Infrared emission from recombination and energy transfer processes of air species; Clean air chemistry and chemiluminescence; Energy partitioning in metal atom chemi-excitation; Neutral-neutral reactions in crossed beams; Processes involving metastable species; Ion-molecule reactions and excitation processes in a fast flow system; Reactions of metal atoms with ions in magnetically confined NO(+) plasmas; Ion-molecule reactions at elevated temperatures; Afterglow studies of the population of excited atomic and molecular states by vibrational energy transfer; Time of flight experiments; Optical interferometer studies of barium releases; Optical photometer studies of nightglow ionospheric modification; Measurement of the ionized and neutral constituents of the atmosphere; Distribution of gases in the mesosphere; and Semiempirical methods for estimating reaction rates. Author (GRA)

N72-31440# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
TRANSMISSION SYSTEMS AND NETWORK ANALOGIES TO GEOPHYSICAL FORWARD AND INVERSE PROBLEMS
Theodore R. Madden 23 May 1972 52 p refs
(Contract N00014-67-A-0204-0045; NR Proj. 371-401)
(AD-744054; Rept-72-3) Avail: NTIS CSCL 20/3

The report describes transmission system and network analogies to geophysical forward and inverse problems. Applications to one, two and three dimensional problems are discussed. The use of network theorems in developing reciprocity and sensitivity relationships that simplify the calculations for solving the inverse boundary value problem is discussed.
Author (GRA)

N72-31441# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A NUMERICAL STUDY OF THE LUNAR TIDAL OSCILLA-

TIONS IN THE EQUATORIAL F REGION Environmental Research Papers
Charles M. Rush 28 Mar. 1972 18 p refs
(AF Proj. 5631)
(AD-744070; AFCRL-72-0217; AFCRL-ERP-394) Avail: NTIS CSCL 04/1

Using the time dependent continuity equation, the latitudinal and temporal variations of the low latitude lunar tidal oscillations are studied. Following the suggestion of Dunford and Lawden (1969), the lunar tide in the equatorial F region is described in terms of changes in the structure of the Appleton anomaly. The lunar-induced ionization changes are determined for the case of no neutral air winds as well as for various wind models.
Author (GRA)

N72-31442# Scripps Institution of Oceanography, La Jolla, Calif.
UPDATED INDEXES OF DIGITIZED NAVIGATION, BATHYMETRIC AND MAGNETIC DATE IN THE PACIFIC OCEAN FROM SCRIPPS INSTITUTION OF OCEANOGRAPHY AND OTHER SOURCES
Stuart M. Smith, George F. Sharman, and Uta Ritter 19 Mar. 1972 40 p
(Contract N00014-69-A-0200-6006)
(AD-741185; SIO-Ref-71-6) Avail: NTIS CSCL 08/10

In January 1970, SIO Reference Report 70-1 was issued which presented indexes of digitized navigation, bathymetric and magnetic data in the Pacific Ocean with general descriptions of the available forms of digital and graphic output, as well as notes on sources of data and processing methods. Since that time, a sufficient amount of additional data from recent SIO cruises has been processed to warrant updating and re-issuing these index charts and tables. The data are indexed in four separate catagories: (1) SIO Bathymetry, (2) Non-SIO Bathymetry, (3) SIO Magnetics and (4) Project MAGNET flights.
Author (GRA)

N72-31443# Wisconsin Univ., Madison. Center for Climatic Research.
VEGETATION AND TERRAIN (ENVIRONMENT): CANADIAN BOREAL FOREST AND TUNDRA Final Report, 1970-1972
James A. Larsen Feb. 1972 246 p refs
(Grants DA-ARO(D)-31-124-70-G43;
DA-ARO(D)-31-126-G1128)
(AD-742724; UW-G1128; AROD-8058:3-EN) Avail: NTIS CSCL 06/6

Vegetational and terrain data from 44 study sites in boreal forest and tundra of Canada west of Hudson Bay are employed to discern relationships between vegetation and climate, describe structural characteristics of vegetational communities, provide interpretation of vegetational and terrain features from aerial photographs (photo-interpretive keys), establish a generalized systematic categorization of the region based on vegetation, climate, terrain, topography, and surficial geology, and subdivide the entire area into regions.
Author (GRA)

N72-31814* Grumman Aerospace Corp., Bethpage, N.Y.
MEASUREMENTS OF THE EARTH'S AIRGLOW IN THE VACUUM ULTRAVIOLET
C. R. Waters and E. S. Fishburne *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 51-59 refs (For availability see N72-31810 22-30)
CSCL 04A

N72-31815* Michigan Univ., Ann Arbor.
TERRESTRIAL ATMOSPHERIC COMPOSITION FROM STELLAR OCCULTATIONS
P. B. Hays, R. G. Roble (Natl. Center for Atmospheric Res., Boulder, Colo.), and A. N. Shah *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 61-69 refs (For availability see N72-31810 22-30)
CSCL 04A

N72-31152 Michigan Univ., Ann Arbor. School of Public Health.
ANALYTICAL PROBLEMS IN WATER POLLUTION CONTROL
Khalil H. Mancy *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 297-390 refs (For availability see N72-31146 22-06)

N72-31153 Johns Hopkins Univ., Baltimore, Md.
PROBLEMS IN APPLICATIONS OF ANALYTICAL CHEMISTRY TO OCEANOGRAPHY
James H. Carpenter *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 391-430 refs (For availability see N72-31146 22-06)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-31444+ Department of Energy, Mines and Resources, Ottawa (Ontario).
SENSORS
Dennis White 1971 61 p refs
(Rept-10) Copyright. Avail: NTIS Avail: Issuing Activity

The conclusions and recommendations of the working group on sensors regarding the identification of those parameters and physical variables that have relevance to a Canadian resource satellite and airborne sensing program are discussed. Although efforts were made to identify significant parameters and physical quantities prior to soliciting and evaluating development program proposals, a more extensive study of user needs was made to provide guidance and direction for future sensor developments. A user parameter study was conducted to articulate the needs of the user groups and provide a framework for evaluating sensor research and development to Canadian requirements and future programs. User groups and sensor development groups were brought together in organized workshops. Following the workshop discussions, proposals were called from 64 potential bidders; 53 of whom submitted proposals. Eleven contracts were subsequently placed and comprise 12 programs.
Author

N72-31445 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
AN ELECTRIC FURNACE FOR THE STUDY OF MAGNETIC PROPERTIES OF ROCKS [UN FOUR ELECTRIQUE POUR L'ETUDE DES PROPRIETES MAGNETIQUES DES ROCHES]
J.-L. Roy, E. Sanders, and J. Reynolds 1972 12 p refs In FRENCH; ENGLISH summary
(M70-42/8F) Copyright. Avail: Issuing Activity

The construction, characteristics, and performance of an electric oven (diameter 30.5 cm, height 20.3 cm) are described. The nonmagnetic materials used are discussed. The oven can accommodate 120 cylindrical samples (diameter 2.5 cm, height 2.2 cm) within a magnetic field < 6 gamma; 45 of which are within a field < 1 gamma. The magnetic field and the temperature are controlled automatically.
Author

N72-31446* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SEMICONDUCTOR TRANSDUCER DEVICE Patent
Wilhelm Rindner, Americo Iannini, and Andre Garfein, inventors (to NASA) Issued 22 Aug. 1972 5 p Filed 23 Nov. 1970 Supersedes N72-21430 (10 - 12, p 1610) Continuation-in-part

of US Patent Appl. SN-738315, filed 19 Jun. 1968
(NASA-Case-ERC-10087-2; US-Patent-3,686,542;
US-Patent-Appl-SN-91642; US-Patent-Class-317-235R;
US-Patent-Class-317-235M; US-Patent-Class-317-234D;
US-Patent-Class-317-234G; US-Patent-Class-29-588;
US-Patent-Appl-SN-738315) Avail: US Patent Office CSCL 14B

A miniature electromechanical junction transducer is described, the operation of which is based on piezojunction effect. The mechanical imput coupling member is formed in situ and is spread over the top of the mesa structure to form an exact duplicate of the mesa surface at the area of contact.
Official Gazette of the U.S. Patent Office

N72-31447# Forest Management Inst., Ottawa (Ontario).
LARGE SCALE AERIAL PHOTOGRAPHY AND RADAR ALTIMETRY: THE STATE OF THE ART
L. Sayn-Wittgenstein [1972] 10 p refs Presented at 15th IUFRO Congr., Florida, Mar. 1971
Avail: NTIS HC $3.00

The feasibility of using large scale aerial photography coupled with specially designed radar altimeters for forest inventories is investigated. Test results show that technically such a system can be employed. E.H.W.

N72-31448# Ecole Polytechnique, Montreal (Quebec). Dept. of Geological Engineering.
MULTISPECTRAL IMAGERY AND AUTOMATIC CLASSIFICATION OF SPECTRAL RESPONSE FOR DETAILED ENGINEERING SOILS MAPPING
Marc G. Tanguay, Roger M. Hoffer (Purdue Univ.), and Robert D. Miles (Purdue Univ.) [1972] 31 p refs Sponsored by Bur. of Public Roads and Indianna State Highway Comm.
Avail: NTIS HC $3.75

The project involved the evaluation of imagery taken in fifteen discrete bands of the spectrum as a source of data on engineering soils. The multispectral data was evaluated by (1) visual means, (2) densitometric measurements, and (3) an automatic spectral response classification method. Classification maps representing seven soil types of different engineering significance were obtained. There is an indication that useful automatic classification of soils can be made and printed on a computer map using multispectral data collected between the ultraviolet and the far infrared range of the spectrum. Information on limited laboratory reflectance measurements is also reported.
Author

N72-31449# Communications Research Centre, Ottawa (Ontario).
THEORY AND FIELD TESTS OF A UHF RADIOMETER FOR DETERMINING SEA ICE THICKNESS
A. W. Adey, T. R. Hartz, R. E. Barrington, W. Rolfe, and W. E. Mather Jan. 1972 17 p refs Presented at the Symp. on Remote Sensing and Earth Resource Satellites, Toronto, 15-16 Mar. 1971
(CRC-TN-637) Avail: NTIS HC $3.00

A theoretical analysis of the UHF emissions from sea ice and/or sea water is outlined. This work indicates that a radiometer system designed to observe these emissions could be used to determine the thickness of sea ice. To explore this possibility, a radiometer operating at frequencies from 400 MHz to 2.3 GHz was designed and built. The results of initial ground-based and airborne tests of this instrument are presented. Comparisons are made between the field observations and the theory. Author

N72-31450# Barringer Research Ltd., Rexdale (Ontario).
RADIOPHASE: A NEW SYSTEM OF CONDUCTIVITY MAPPING
A. R. Barringer and J. D. McNeill [1968] 11 p refs
Avail: NTIS HC $3.00

A new system, called Radiophase, utilizes the signals from VLF radio stations to detect the presence of dipping conductive sheets in the ground, and to estimate the surface impedance of a homogeneous or horizontally stratified earth. The technique measures those components of the VLF horizontal magnetic and electric fields which are in phase quadrature with the vertical electric field. Both theoretical studies and modelling have demonstrated that these quadrature components are greatly influenced by the impedance of the underlying terrain. An airborne version of the system was flown on surveys over known mineral occurrences. Preliminary results suggest interesting correlation between the Radiophase signals and the underlying geology. Other potential applications include the airborne mapping of water conductivity to determine the extent of pollution and estuarine salinity, and airborne mapping of ground conductivity to locate faults, shear zones, the distribution of permafrost, aquifers, etc. Author

N72-31451# National Aerospace Lab., Tokyo (Japan).
HEIGHT CONTROL TEST EQUIPMENT FOR VTOL AIRCRAFT
Masakatsu Matsuki, Tadao Torisaki, Kenji Nishio, Masanori Endo, Akira Yoshida, Susumu Nakayama, Tadasuke Iwabe, Katsumi Takeda, Shizuo Sekine, and Takeshi Koshinuma 1972 42 p refs In JAPANESE; ENGLISH summary
(NAL-TR-275) Avail: NTIS HC $4.25

The theoretical and experimental investigation of height control systems for VTOL aircraft by means of height control test equipment is presented. The installations and instruments in height control test equipment were deliberately designed and constructed to meet the requirements for the safe and accident-proof operation as well as for the execution of new and fresh experiments. A 40-meter-height iron tower, one of the installations, was equipped on its side with rails along which a lorry freely runs up and down by means of the thrust generated by two lift jet engines (JR100H) mounted on it. The thrust of two engines were remotely controlled from the ground to reach the predetermined height. The maximum velocity and acceleration permitted were 10 m/s and 0.3 g respectively.
Author

N72-31452# Joint Publications Research Service, Arlington, Va.
AERONAUTICAL INSTRUMENTS
L. I. Tkachev 27 Jul. 1972 76 p refs Transl. into ENGLISH from Avtomat. Telemekh. (Moscow), 1948 p 223-254; from Dokl. Nauch.-Tekh. Konf. Itogam Nauch.-Issledovatel. Rabot 1966-1967 Gody, Mosk. Energ. Inst., Sekts. automat., Vychisl. Izmer. Tekh., Podsekts. Automat. Telemekh., part 2 (Moscow), 1967 p 108-121; and from Dokl. Nauch.-Tekh. Konf. Itogam Nauch.-Issledovatel. Rabot 1966-1967 Gody, Mosk. Energ. Inst., Sekts. automat., Vychisl. Izmer. Tekh., Podsekts. Sistemotekh. (Moscow), Apr. 1970 p 99-127
(JPRS-56624) Avail: NTIS HC $6.00

Articles on the aircraft vertical indicator, spatial orientation and guidance, and inertial guidance information systems are presented. For individual titles, see N72-31453 through N72-31455.

N72-31453 Joint Publications Research Service, Arlington, Va.
CONDITIONS OF ADJUSTMENT OF AN AIRCRAFT VERTICAL INDICATOR
L. I. Tkachev *In its* Aeron. Instr. 27 Jul. 1972 p 1-35 refs (For availability see N72-31452 22-14)

The application of a gyropendulum to the construction of a precision vertical indicator was investigated considering all velocities and accelerations during arbitrary displacements in the earth's gravitational field. The coordinate system, movements, and accelerations of gyropendulums are discussed. The expressions for the velocity deviation of an ideal pendulum, ballistic deviation, deviation from vertical movements, and instrument errors are derived from the equations of motion for the gyropendulum. It is concluded that the application of the gyropendulum as an exact vertical indicator is possible only with additional devices. F.O.S.

N72-31454 Joint Publications Research Service, Arlington, Va.
SPATIAL ORIENTATION THEORY
L. I. Tkachev *In its* Aeron. Instr. 27 Jul. 1972 p 36-49 refs
(For availability see N72-31452 22-14)

The theoretical possibility of spatial orientation using mechanical devices during the movement of any given gravitational field is proved. The schematic diagram of the instrument is discussed along with the coordinate system, angular velocities of the platform, and platform accelerations. F.O.S.

N72-31455 Joint Publications Research Service, Arlington, Va.
INERTIAL GUIDANCE INFORMATION SYSTEMS c21
L. I. Tkachev *In its* Aeron. Instr. 27 Jul. 1972 p 50-76 refs
(For availability see N72-31452 22-14)

A historical analysis and classification of inertial navigation are presented. Topics discussed include basic concepts, inertial parameters, precursors to inertial navigation, and the statement and solution of the general problem of inertial navigation. F.O.S.

N72-31456*# Philco-Ford Corp., Newport Beach, Calif.
RAE-B ANTENNA ASPECT SYSTEM
26 Jun. 1972 67 p
(Contract NAS5-11166)
(NASA-CR-122462; U5036) Avail: NTIS HC $5.50 CSCL 14E

The development of a facsimile camera to serve as the antenna aspect system for the second generation Radio Astronomy Explorer Satellite designated RAE-B is summarized. The camera system consists of two cameras and a data encoder. The program deliverables were two flight cameras, a flight encoder and one spare flight encoder. The RAE-B satellite was originally intended for an earth orbit mission and the facsimile subsystem characteristics were specified with this in mind. Subsequently the flight mission was changed to orbit the moon; however the change occurred too late to significantly influence the facsimile system design. Therefore, this report considers only compliance of the system to earth orbit requirements. Author

N72-31457*# New Hampshire Univ., Durham. Dept. of Physics.
A GAMMA RAY MONITOR FOR THE OSO-7 SPACECRAFT
P. R. Higbie, E. L. Chupp, D. J. Forrest, and I. U. Gleske 5 Nov. 1971 24 p refs Presented at IEEE Nucl. Sci. Symp., San Francisco, 3-5 Nov. 1971
(Contract NAS5-11054)
(NASA-CR-122466) Avail: NTIS HC $3.25 CSCL 14B

A 3 in. x 3 in. NaI(Tl) gamma ray (0.3 to 10 MeV) spectrometer with a CsI(Na) charged particle and anti-Compton shield has been developed for the Orbiting Solar Observatory (OSO-7) which was launched September 30, 1971. The instrument, designed for a rotating wheel compartment, utilizes a 377 channel quadratic PHA with accumulation times of 3, 1, or 0.5 minutes. Quick look and calibration data obtained via a direct data link to a minicomputer allows near real time monitoring and control of the experiment. Various commands changing the operating mode can be executed. The functions which can be commanded include: rotation of the quadrants in which data is collected by 90 deg; gain adjustment of the central detector over a 6:1 range; manual or automatic sequencing of calibrations; variations of accumulation times by telemetering selected channels; and selection of reference directions. A small X-ray detector covering the range 7.5 to 120 keV is also included. Author

N72-31458# National Research Council of Canada, Ottawa (Ontario).
CHANGE IN THE SENSITOMETRIC PROPERTIES OF EXPOSED FILM BETWEEN EXPOSURE AND DEVELOPMENT
L. A. Erdelyi 1972 14 p Transl. into ENGLISH from Kep-es Hangtech. (Hungary), v. 14, no. 6, 1968 p 169-172
(NRC-TT-1587) Avail: NTIS HC $3.00

The changes in sensitivity of photographic films which occur as a result of storage are examined. The effects of time and temperature on the materials are described. It was established that in some materials the effect is negligible, while in others even a twenty-four hour storage period significantly reduces the sensitivity and contrast. Changes in storage temperature do not affect all materials uniformly. Practical uses for the information obtained and suggestions for daily work in film laboratories are provided. Author

N72-31459*# Bell Telephone Labs., Inc., Murray Hill, N.J.
ENERGETIC PARTICLES EXPERIMENT INSTRUMENTATION PACKAGING PROGRAM FOR IMP-F (EXPLORER 34) AND IMP-G (EXPLORER 41) NASA INTERPLANETARY MONITORING PLATFORM PROGRAM Final Report, Jun. 1965 - Jun. 1969
1 Jul. 1970 98 p refs
(Contract NAS5-9102)
(NASA-CR-122468) Avail: NTIS HC $7.00 CSCL 14B

The package design and assembly techniques for the IMP-F and IMP-G space-physics experiments, provided for the NASA Interplanetary Monitoring Platform Program are described. Thin-film, hybrid, integrated circuits used in these instruments to increase component density and reliability, and special procedures and precautions for the fabrication of space hardware are described. Author

N72-31460*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A CAPACITIVE ACCELEROMETER SUITABLE FOR TELEMETRY
Grant W. Coon Washington Sep. 1972 20 p refs
(NASA-TM-X-2644; A-4439) Avail: NTIS HC $3.00 CSCL 14B

The design and development of a miniature 0.635 cm (0.25 in.) diameter capacitive accelerometer for use in free flight wind tunnel telemetry are presented. Instruments with full scale ranges from + or - 1 to + or - 200 g were constructed, calibrated, and used in several wind tunnel telemetry projects. Flat, high frequency response from 0 to 1000 Hz or more was obtained by employing the inherent damping and stiffness in the air film surrounding the diaphragm-type spring that supports the inertial mass of the accelerometer. Design features to achieve minimum off-axis sensitivity and temperature stability are discussed, and the design requirements for use of the transducer with telemetry systems are derived. A transducer capacitance change of 0.16 pF full scale gave excellent resolution and provided a frequency deviation of 0.75 MHz for a 100 MHz FM oscillator. Although the present design of the capacitive accelerometer was optimized by using units of 0.635 cm diameter, construction of experimental accelerometers as small as 0.36 cm (0.14 in.) diameter has demonstrated the feasibility of further miniaturization. Author

N72-31461# Technische Hogeschool, Delft (Netherlands).
THE SENSITIVITIES OF DIFFERENT TYPES OF CONTINUOUS WAVE NUCLEAR MAGNETIC RESONANCE SPECTROMETERS Ph.D. Thesis
Robert Anthony Wind 28 Jun. 1972 124 p refs
Avail: NTIS HC $8.25

The signal to noise ratios for the NMR absorption of transitorized NMR spectrometers were investigated in Q meters, Robinson oscillators and PKW oscillators. The principles of magnetic resonances are presented along with the detection of NMR. The sensitivities of the Q meter and Robinson oscillator are investigated theoretically. Probability functions are given with some properties of linear systems. The influence of coaxial cable loss on the signal to noise ratios was also investigated. F.O.S.

N72-31462# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
BUREAU OF MINES INSTRUMENTED IMPACT TESTER: PRELIMINARY STUDIES

K. R. Becker, C. M. Mason, and R. W. Watson [1972] 24 p refs
(BM-RI-7670; TN23.U7) Avail: NTIS HC $3.25

The addition of a force gage and a reaction detector to the drop-weight impact apparatus made it possible to examine the details of the force exerted on the specimen and make estimates of the time to reaction. With the current setup the force was found to be oscillatory and not reproducible. However, single well-defined pressure pulses can be delivered to the explosive sample by modifying the drop-weight tools. With a modified test arrangement, the time to reaction and the peak force and energy at the time of reaction were determined as a function of drop-weight height for several different explosives. All these parameters were found to decrease as the rate of force application was increased. The same parameters were also found to vary with the thickness of the test sample. The implications of these results are discussed in terms of practical drop-weight testing. Author

N72-31463*# Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT AND EVALUATION OF VACUUM PRESSURE GAUGE COMPONENTS FROM CARBON AND GRAPHITE Technical Report, 21 Apr. 1971 - 21 Apr. 1972
David K. Benson and George A. Beitel Washington NASA Sep. 1972 28 p refs
(Contract NAS1-10738)
(NASA-CR-2101; C-2922) Avail: NTIS HC $3.00 CSCL 14B

A prototype all carbon triode ultrahigh vacuum gage was fabricated and tested. The gage exhibited a sensitivity of 3.7 per torr for nitrogen and an X-ray background approximately 0.1 as large as would be expected of a metal gage of the same design. The gage made from these materials, showed good sensitivity and durability. A practical technique was developed for bonding carbon components together without metal fasteners. The bond is made with a cross-linked phenolic resin which is converted to vitreous carbon by a careful pyrolysis procedure. The resulting bonds are strong, electrically conductive, and can withstand repeated excursions to 2500 K in vacuum. Measurements of adsorption and outgassing characteristics of four refractory carbons have confirmed that such materials are suitable for use in ultrahigh vacuum and that some are superior refractory metals in man respects. Author

N72-31464# Technische Hochschule Munchen (West Germany).
DEVELOPMENT OF HOT WIRE ANEMOMETER WITH HIGH TIME RESOLUTION FOR FLOW MEASUREMENTS IN COMBUSTION ENGINES Ph.D. Thesis [ENTWICKLUNG EINES HITZDRAHT-ANEMOMETERS HOHER ZEITLICHER AUFLOESUNG ZUR STROEMUNGSMESSUNG IN VERBRENNUNGSMOTOREN]
Michael Horvatin 1971 191 p refs In GERMAN
Avail: NTIS HC $11.75

The hot wire anemometer, using one wire only is only applicable to engine combustion flow measurements if the heat conduction and heat transfer functions at the measuring wire are used for signal evaluation. It is shown that the Nu-Re-relations of Hilpert are generally applicable for determining instrument scattering constants. Transl. by G.G.

N72-31465# Atomic Energy Establishment, Cairo (Egypt). Nuclear Physics Dept.
THE 50 cm IRON-FREE DOUBLE FOCUSING ELECTRON SPECTROMETER AT THE ATOMIC ENERGY ESTABLISHMENT, UNITED ARAB REPUBLIC
O. Nilsson, M. Migahed, M. A. Mostafa, A. H. El-Farrash, M. G. Abdel-Hamid, and A. Abdel-Haliem 1971 15 p
(UARAEE-121) Avail: AEC Depository Libraries

A reconstruction of the iron-free double focusing electron spectrometer is described. Installations of new and precise equipment in the current regulating and measuring system are described. Recordings of the isoaberration contours were performed and then four fixed baffles were shaped corresponding to different resolutions. The internal conversion L-spectrum of the 99 keV and 100 keV transitions in w-183 and w-182 was taken as an example of the recorded spectra. A resolution of approximately 0.07 percent was recorded using the smallest baffle and a thin source. Author (NSA)

N72-31466# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
RC PULSE SHAPER FROM THE SEMICONDUCTOR RADIATION DETECTORS WITH THREE-FOLD DIFFERENTIATION
S. I. Ormandzhiev 1972 16 p refs In RUSSIAN
(JINR-P13-6219) Avail: AEC Depository Libraries

A system with three differentiating and n integrating RC circuits for pulse shaping from semiconductor detectors was investigated. The formulae for the pulse parameters, signal-to-noise ratio, and resolution time was obtained. The parameters of the schemes are compared with the single-, two- and three-fold differentiation. The calculation results are listed in tables and graphs. Author (NSA)

N72-31467# Cologne Univ. (West Germany). Inst. of Geophysics and Meteorology.
A NEW PHOTOGRAPHIC INTERPRETATION AID IN METEOROLOGY AND ATMOSPHERIC PHYSICS [EINE NEUE FOTOGRAFISCHE INTERPRETATIONSHILFE IN DER METEOROLOGIE UND DER PHYSIK DER ATMOSPHAERE]
W. Ruge Mar. 1972 33 p refs In GERMAN
(MITT-18) Avail: NTIS HC $3.75

An evaluation of the Agfacontour film is presented. It appears possible that this film can be used to enhance images showing small contrast. Use of chromatic developer and superposition of positives obtained leads to an image on which isodensity lines are easy to draw. Use of such a process for cloud photography and the possibility to identify thermal fluxes in the atmosphere are discussed. ESRO

N72-31468# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
VISUAL SIMULATION METHOD WITH PERSPECTIVE DISTORTION OF TV DISPLAY SCANNING PATTERNS FOR FLIGHT MISSIONS WITH RESTRICTED FREEDOM OF MANEUVER [EIN VERFAHREN ZUR SICHTSIMULATION MIT PERSPEKTIVISCHER VERZEICHNUNG VON FERNSEHDARSTELLUNGSRASTERN FUER FLUGMISSIONEN MIT EINGESCHRAENKTER MANOEVERFREIHEIT]
H. Heising and K.-D. Schulz-Helbach May 1972 37 p refs In GERMAN; ENGLISH summary
(Anthro-Mitt-2/72) Avail: NTIS HC $4.00; Forschungsinst. fuer Anthropotech. 6 DM

A type of visual simulation is presented which is realized by computing the distortion of the scanning pattern at a TV display or at an intermediate image according to the desired perspective. The visible earth surface can be described as approximating a textured plane, if special assumptions are made. It is therefore possible to transform the perspective of pictures originally obtained during an aero mission for the simulation display. The mathematics necessary to achieve the distortion of the TV pictures can be solved by means of hybrid computation. Magnetic tapes or disks can be used as a memory to store the TV imagery. The method is suitable for visual simulation of missions with certain restrictions of the freedom of maneuver. ESRO

N72-31469# Institut Franco-Allemand de Recherches, St. Louis (France).
UTILIZATION OF AN IMAGE AMPLIFIER FOR RECORDING

RADIOCRYSTALLOGRAPHIC DIAGRAMS OBTAINED BY PULSED X RAYS [UTILISATION D'UN AMPLIFICATEUR DE LUMINANCE POUR L'ENREGISTREMENT DE DIAGRAMMES RADIOCRISTALLOGRAPHIQUES OBTENUS AVEC DES IMPULSIONS DE RAYONS X]

F. Jamet 12 Oct. 1971 42 p In FRENCH
(ISL-30/71) Avail: NTIS HC $4.25

Radiocrystallograhic diagrams were recorded by the powder method using an image amplifier with 100 nsec exposure time. Two transmission and reflection recordings are described and applied to the analysis of high speed phenomena such as the time evolution of the powder diagram of an exploding thin gold foil. ESRO

N72-31470# Institut Franco-Allemand de Recherches, St. Louis (France).

ANALYSIS OF IMPURITIES IN THE HYPERSONIC FLOW OF THE ONERA ARC 2 WIND TUNNEL [ANALYSE DES IMPURETES DANS L'ECOULEMENT HYPERSONIQUE DE LA SOUFFLERIE ARC 2 DE L'ONERA]

F. Aulinger and H. Trinks 15 Nov. 1971 25 p refs In FRENCH Presented at the 8th Appl. Aerodyn. Colloq., St. Louis, France, 8-10 Nov. 1971; sponsored by Assoc. Franc. des Ingr. et Techniciens de l'Aeron. et de l'Espace (AFITAE)
(ISL-40/71) Avail: NTIS HC $3.25

The hypersonic flow and dissociation degree of nitrogen and oxygen in a shock tube as well as gaseous products generated by electric discharges in a hypersonic wind tunnel were analyzed using a quamopol mass spectrometer. Some information was obtained on the dissociation degree of oxygen in the shock tube. However, an excessive formation of nitrogen in the mass spectrometer, greater than in the hypersonic flow, prevented an analysis of the dissociation degree of nitrogen. Some gaseous products such as SiC and H2 were identified in the hypersonic wind tunnel. ESRO

N72-31471# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABSOLUTE SPECTRAL SENSITIVITY OF PHOTOGRAPHIC MATERIALS MADE BY GOSNIIKHIMFOTOPROEKT FOR RECORDING SHORT-WAVE ULTRAVIOLET RADIATION

A. V. Kravchenko, N. G. Morozova, and G. P. Startev 3 Apr. 1972 12 p refs Transl. into ENGLISH from Zh. Nauchn. i Prikl. Fotogr. i Kinematogr. (Moscow), v. 15, no. 3, 1970 p 161-166
(AF Proj. 7660)
(AD-743141; FTD-HC-23-1845-71) Avail: NTIS CSCL 14/5

Gosniikhimfotoproyekt has developed special photographic materials for recording spectra in the vacuum ultraviolet (UV) region. Until now no data were available on the spectral sensitivity of photographic materials in the 20 to 100 nm range. Presented in the report are the results of determination of the absolute spectral sensitivity of photographic films developed by Gosniikhimfotoproyekt in the broad spectral region from 30 to 450 nm and the procedure of the measurement and the set-up employed in the work are described. GRA

N72-31472# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

TRANSIENT RESPONSE OF A MASS SPECTROMETER WITH A BRINK IONIZER Final Report

George T. Skinner Apr. 1972 69 p refs
(Contract F44620-71-C-0050)
(AD-743211; CAL-RM-3062-A-1; AFOSR-72-0938TR) Avail: NTIS CSCL 14/2

A study has been made of the performance of a Brink ionizer which is part of a mass spectrometer in a molecular-beam apparatus. It has been shown that the potentials applied to the exit apperature plate have a pronounced effect on which regions of the ionizer contribute the bulk of the selected ions passed through the mass filter. The properly adjusted instrument has been used to observe the scattering of a 2.2 eV Ar beam from various target gases and from a solid surface. Some time-resolved details of these processes have been compared with theory.
Author (GRA)

N72-31473# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

VISCOMETER OF INTERMITTENT AND CONTINUOUS ACTION

I. V. Provinteev and B. M. Gershkovich 25 Feb. 1972 13 p refs Transl. into ENGLISH from Lakokrasoch. Mater. Ikh Primen. (Moscow), no. 1, 1967 p 55-57
(AD-742679; FTD-HT-23-1305-71) Avail: NTIS CSCL 14/2

A description of a new viscometer of intermittent and continuous action is given. The action of the viscometer is based on a forced flow of the test liquid at a constant rate through a clearance formed by coaxial cylinders, the internal cylinder (piston) being mobile; under the action of the liquid, the piston acts on a dynamometric device, the form of this action depending on the viscosity of the liquid. The theory of the device is discussed. GRA

N72-31474# Brown Univ., Providence, R.I. Engineering Materials Research Lab.

AN EXTENSOMETER FOR CIRCUMFERENTIAL STRAINS

William N. Findley and R. M. Reed Mar. 1972 9 p refs
(Contract ARPA SD-86)
(AD-742827; EMRL-46; ARPA-E79) Avail: NTIS CSCL 14/2

The report describes the adaptation of direct current differential transformers in the design of an extensometer. The instrument is used to measure creep of plastic materials under axial compression and/or internal pressure. GRA

N72-31475# Army Foreign Science and Technology Center, Charlottesville, Va.

THE PROJECTION OF PHOTOGRAPHS BY LINEAR CONGRUENCE

L. N. Vasilev 9 Apr. 1972 15 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 6, 1971 p 57-63
(AD-743041; FSTC-HT-23-926-72) Avail: NTIS CSCL 14/5

In many types of photography the image recorded on the film was not produced by rays which all pass through a common focal point. Causes of this phenomenon include the use of focal plane shutters in aerial photography from high speed aircraft, various types of lenses, scanning procedures in radar imaging, etc. The use of linear congruence constructions permits these images to be treated mathematically without introducing distortions based on the assumption of a common focal point.
Author (GRA)

N72-31476# Naval Ordnance Lab., White Oak, Md. Environment Simulation Div.

CALIBRATION OF NOL COPPER BALL ACCELEROMETERS

Glenn L. Matteson 7 Mar. 1972 29 p refs
(AD-742771; NOLTR-72-67) Avail: NTIS CSCL 14/2

Copper-ball accelerometer operation and utility as a shock spectrum measuring device are discussed. The results of dynamic and static tests of copper balls are recorded. A comparison is made of the dynamic and static properties of copper balls. In order to arrive at a more accurate calibration of copper-ball accelerometers, correction is made for the non-linear deformation characteristics of the copper balls. Corrected accelerometer functions are presented in easy-to-use curves and nomographs for velocity change, peak g, and associated natural frequency.
Author (GRA)

N72-31477# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

ULTRASENSITIVE SUPERCONDUCTING MAGNETIC GRADIOMETER Final Report, 1 Jan. - 31 Dec. 1971

James E. Zimmerman and Nolan V. Frederick 31 Mar. 1972 45 p refs
(Contract NAonr-13-71)
(AD-742794; NBS-R-10736) Avail: NTIS CSCL 14/2

A compact battery-operated superconducting magnetic gradiometer with 10 to the minus 11th power gauss/cm (Hz to the 1/2 power) sensitivity has been built. It has been balanced

to better than 50 ppm of the projected axial area in all three orthogonal directions. The sensor SQUID is a multihole fractional turn type, coupled to multi-turn pickup loops made of fine wire to minimize flux trapping and jumping. The cryostat is a light-weight, non-metallic dewar with vapor-cooled radiation shields which holds one liter of liquid helium and operates in excess of 24 hours on one filling. A uht (300 MHz) low-noise bias system has been developed which can provide a considerable increase of sensitivity when it is incorporated into the system. A data recording system is described which utilizes a battery-operated tape recorder with frequency modulation and demodulation circuits to improve the linearity. A new type of SQUID has been developed for use in the gradiometer and other applications. It combines the reliability of a Nb thin-film microbridge with the low inductance of a bulk Nb ring.
Author (GRA)

N72-31478# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF AN ULTRASONIC VELOCIMETER SYSTEM FOR THE STUDY OF ACOUSTIC AND THERMODYNAMIC PROPERTIES OF LIQUID M.S. Thesis
Richard Wesley Dawson Dec. 1971 38 p refs
(AD-742931) Avail: NTIS CSCL 14/2

An ultrasonic velocimeter system using two nearly identical velocimeters was developed that could measure the differences in speeds of sound between pure liquids and solutions over the pressure range ambient to 2000 psi and the temperature range ambient to 100 C. Accuracy of two parts in 1/one million in frequency corresponding to an average deviation in the speed for sound of 0.3 cm/sec is demonstrated. Author (GRA)

N72-31479# Army Engineer Topographic Labs., Fort Belvoir, Va.
ERROR PROPAGATION IN TWO-PHOTO INTERSECTION Research Note, Jun. - Jul. 1971
Michael A. Crombie Feb. 1972 23 p
(DA Proj. 4A6-62707-A-852)
(AD-743179; ETL-RN-72-1) Avail: NTIS CSCL 14/5

Algebraic expressions are presented which can be used in an error analysis to determine the effect of image error on ground points intersected from two photographs. Results are derived for vertical photography, convergent photography, and split vertical photography. The last result can be used to evaluate vertical panoramic cameras. Author (GRA)

N72-31480# ARO, Inc., Arnold Air Force Station, Tenn.
WIND TUNNEL TEST RESULTS ON A FLIGHT PATH ACCELEROMETER AT SUBSONIC AND SUPERSONIC SPEED Final Report, 6 Dec. 1971 - 24 Jan. 1972
James C. Uselton AEDC Jun. 1972 17 p refs
(Contract F40600-72-C-0003; AF Proj. 6903)
(AD-742994; ARO-VKF-TR-72-14; AEDC-TR-72-45) Avail: NTIS CSCL 14/2

A test program was conducted to obtain the damping characteristics of the vanes and to provide a flow calibration of a newly developed flight path accelerometer (FPA). After earlier calibration results identified an interference problem from the sideslip vane strut on the angle-of-attack vanes, the sideslip vane was moved rearward, necessitating additional calibration tests. Results are reported. Author (GRA)

N72-31481# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME NEW APPLICATIONAL POSSIBILITIES OF HOLOGRAPH
S. Reichmann 1 Mar. 1972 17 p ref Transl. into ENGLISH from Militaertechnik (East Germany), no. 6, 1970 p 249-252
(AD-742710; FTD-HT-23-1288-71) Avail: NTIS CSCL 14/5

The report discusses possible applications of holography in the following areas: Holographic mass storage; Holographic film recording; Holographic television; Holographic X-ray microscope; Holographic supersonic camera; High frequency holography; Slant sight radar holography. GRA

N72-31482# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A LARGE AREA INFINITESIMAL-SHEAR LASER INTERFEROMETER
F. Weinberg, J. E. Creeden, R. M. Fristrom, and C. Grunfelder 19 Apr. 1972 10 p refs
(Grant NSF GI-12)
(PB-208444; NSF-72-34-GI-12) Avail: NTIS HC $3.00 CSCL 14B

The invention is an interferometer comprised of two shadowgraphs minutely displaced with respect to each other to provide a field at least three feet in diameter with sufficient illumination for exposures shorter than 0.04 second. The optical system of the invention comprises a 50 mW helium-neon laser focused by a dual lens to allow variation of focal length, hence beam divergence. Interference is achieved by using the front and rear reflections from a back surfaced mirror used at oblique incidence. Author (GRA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-31483* Bendix Corp., Teterboro, N.J.
EVACUATION VALVE Patent
Burton W. Roney, inventor (to NASA) Issued 1 Aug. 1972 4 p Filed 5 Jan. 1971 Supersedes N71-34421 (09 - 21, p 3432) Sponsored by NASA
(NASA-Case-LAR-10061-1; US-Patent-3,680,830; US-Patent-Appl-SN-104047; US-Patent-Class-251-86; US-Patent-Class-251-331) Avail: US Patent Office CSCL 13K

A packless valve is described with a quick reaction, single-throw, open-closed control and a quick-connect adapter for attachment to a vacuum line and a vacuum pump. A bellows connecting the valve head to the valve casing seals off the seating mechanism from the fluid flowing through the valve. The bellows and a spring act to hold the valve head in a seated position. A ball and socket joint connects the valve stem to the valve head. The valve head is free to swivel as it is seated producing an automatic valve alinement and a better valve seal. An O-ring fitted in a groove in the valve head also serves to seal the valve head in the seat. A two-position cam lever moves the valve stem through a self-lubricating bushing to open and close the valve. Official Gazette of the U.S. Patent Office

N72-31484# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering
FLEXIBLE STEPPED THRUST BEARINGS
C. Dayson Apr. 1972 48 p refs
(MP-58; NRC-12642) Avail: NTIS HC $4.50

A means is suggested by which a stepped thrust bearing can be adapted so that it operates at or near its optimum operating condition over a wide range of applied load. It is shown theoretically that when the outlet step is mounted on an elastic foundation of the correct stiffness, the changes in step height with load enable the bearing to operate with a greater outlet film thickness at high loads or with less friction and a smaller oil temperature rise at lower loads, than can be obtained with the conventional bearing. Several practical arrangements for the construction of these bearings are suggested. The basis for the design of another type of flexible stepped bearings is suggested in which the step height varies with sliding speed and lubricant viscosity as well as the applied load, so that the bearing operates with maximum possible outlet film thickness at higher temperatures than normal or at slow speeds. Author

N72-31485# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
VIBRATION MEASUREMENT AND ANALYSIS, STATING ACCELERATION, VELOCITY AND DISPLACEMENT OF VIBRATING SURFACES IN A LARGE SIZE BLOWER
L. X. Nepomuceno 10 May 1972 47 p In PORTUGUESE; ENGLISH summary
(TR-7205-578) Avail: NTIS HC $4.50

The results are presented of internal and external vibration measurements for an industrial type blower. The results are tabulated for frequency and db at various distances for vertical and horizontal components. Transl. by F.O.S.

N72-31486# Joint Publications Research Service, Arlington, Va.
RELIABILITY AND QUALITY CONTROL
16 Aug. 1972 20 p refs Transl. into ENGLISH from Nadezhnost i Kontrol Kachestva (Moscow), no. 12, 1970
(JPRS-56783) Avail: NTIS HC $3.00

Articles are presented on the estimation of long term durability of materials with long periods of service, on rejection models of failure for prolonged storage and for accelerated tests for shelf life, and on the technical assignment of quantitative indicators for parts of a high reliability system. For individual titles, see N72-31487 through N72-31489.

N72-31487 Joint Publications Research Service, Arlington, Va.
ESTIMATION OF LONG TERM DURABILITY OF MATERIALS WITH LONG PERIODS OF SERVICE
I. I. Trunin *In its* Reliability and Quality Control 16 Aug. 1972 p 1-6 refs (For availability see N72-31486 22-15)

The use of statistical processes and analysis to determine the long term service life of materials that had already undergone long term use is discussed. Estimates were obtained for time of failure, temperature caused deformation, and the maximum stress that could be applied to the materials. The reliability of the estimation methods is given. E.H.W.

N72-31488 Joint Publications Research Service, Arlington, Va.
REJECTION MODELS OF FAILURES FOR PROLONGED STORAGE AND FOR ACCELERATED TESTS OF PRODUCTS FOR SHELF LIFE
V. M. Yelkin *In its* Reliability and Quality Control 16 Aug. 1972 p 7-15 refs (For availability see N72-31486 22-15)

The use of rejection models to determine probability density of failure, probability of failure free operation, or failure intensity of products during accelerated tests is examined. The tests were also used in an effort to establish the shelf life of products. E.H.W.

N72-31489 Joint Publications Research Service, Arlington, Va.
TECHNICAL ASSIGNMENT FOR QUANTITATIVE INDICATORS OF THE PARTS OF A HIGH RELIABILITY SYSTEM
S. V. Gendler *In its* Reliability and Quality Control 16 Aug. 1972 p 16-20 refs (For availability see N72-31486 22-15)

The technical conditions necessary for failure free operation of the component blocks of a high reliability system are determined. E.H.W.

N72-31490*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INSERT FACING TOOL Patent Application
William J. Abernathy and Lowell G. Snoddy, inventors (to NASA) Filed 2 Aug. 1972 9 p
(NASA-Case-MFS-21485-1; US-Patent-Appl-SN-277436) Avail: NTIS HC $3.00 CSCL 13I

A manually actuated tool for facing the exposed end of an insert installed in a honeycomb panel so that the end of the insert will be flush with or slightly undercut from the outer surface of the honeycomb panel is described. The inserts are installed in the panels to provide a means for fastening items to the panel. The operation of the tool is described and illustrated. NASA

N72-31491*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING ROLLING ELEMENTS FOR BEARINGS Patent Application
Richard J. Parker, inventor (to NASA) Filed 14 Aug. 1972 9 p
(NASA-Case-LEW-11087-2; US-Patent-Appl-SN-280390) Avail: NTIS HC $3.00 CSCL 13I

A rolling element either has a hollow center or is made of a low density material to reduce its mass. This low mass core is plated to provide a hard surface. NASA

N72-31492*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
VEHICLE-SCALE INVESTIGATION OF A FLUORINE JET-PUMP LIQUID HYDROGEN TANK PRESSURIZATION SYSTEM Final Report, 1 Jul. 1971 - 31 Jan. 1972
E. C. Cady and D. W. Kendle 28 Feb. 1972 140 p refs
(Contract NAS3-14381)
(NASA-CR-120947; MDC-G2763) Avail: NTIS HC $9.00 CSCL 13K

A comprehensive analytical and experimental program was performed to evaluate the performance of a fluorine-hydrogen jet-pump injector for main tank injection (MTI) pressurization of a liquid hydrogen (LH2) tank. The injector performance during pressurization and LH2 expulsion was determined by a series of seven tests of a full-scale injector and MTI pressure control system in a 28.3 cu m (1000 cu ft) flight-weight LH2 tank. Although the injector did not effectively jet-pump LH2 continuously, it showed improved pressurization performance compared to straight-pipe injectors tested under the same conditions in a previous program. The MTI computer code was modified to allow performance prediction for the jet-pump injector. Author

N72-31493*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EJECTABLE UNDERWATER SOUND SOURCE RECOVERY ASSEMBLY Patent Application
Stephen C. Irick, inventor (to NASA) Filed 19 Jul. 1972 11 p
(NASA-Case-LAR-10595-1; US-Patent-Appl-SN-273240) Avail: NTIS HC $3.00 CSCL 09E

For ejectable mounting on a mobile device intended to travel over water to facilitate location and recovery of the device when submerged, an underwater sound source is mounted in a mounting bracket which is attachable to the device so as to detach or eject upon impact, destruction, or automatically at a prescribed time or under prescribed conditions. Attachment means comprise bolts adapted to fracture upon impact with water. A length of flexible line coiled within a line housing coupled to the mounting bracket maintains a flexible connection between the mobile device and the sound source. An aerodynamic fairing which provides a clean aerodynamic surface during flight is adapted to separate from the bracket upon ejection from the mobile device. During recovery, the sound source is located by a diver, and the line leads to the device. NASA

N72-31494*# National Aeronautics and Space Administration, Washington, D.C.
HAND TOOLS: A COMPILATION
[1972] 26 p refs
(NASA-SP-5908(04)) Avail: NTIS HC $1.00 CSCL 13I

A selection of new hand tools, modifications of existing tools, and techniques developed in the course of NASA research and development projects are presented. The items are presented in two sections: tools for cable and connector applications, and tools for welding applications. Safety is emphasized, together with ease of operation and use in restricted areas or hazardous environments. The discussions are directed primarily toward the technician engaged in assembly or maintenance of mechanical or electrical equipment. Author

N72-31495*# Martin Marietta Corp., Denver, Colo.
INVESTIGATION OF FORMING CURVED ABLATIVE PANELS FROM FLAT PANELS FOR SPACE SHUTTLE Final Report
Huel H. Chandler [1972] 28 p refs
(Contract NAS1-10793)
(NASA-CR-112135; MCR-72-188) Avail: NTIS HC $3.50 CSCL 13H

The purpose of this study was to determine the feasibility of reforming flat ablative panels to a curved configuration. The study indicated that if the panels could be shaped to a radius of 2.54 m (100 in.) then 88.7% of the surface area of the orbiter could be covered, and that if they could be shaped to a radius of 3.81 m (150 in.) then 77.2% of the surface could be covered. Two basic approaches were followed to determine the best method for forming the flat panels to a curved shape. The first was to determine if partially cured panels could be formed, allowing the forming heat cycle to complete the curing of the ablator. The second method was to form fully cured flat panels into the desired curvature through a secondary heat cycle. Measurements made on the panels during storage indicated that they continued to straighten out over time. This was attributed to residual stresses locked into the panels that had not been fully relaxed by the heat cycle. Author

N72-31496*# Arde, Inc., Mahwah, N.J.
METALLIC POSITIVE EXPULSION DIAPHRAGMS
D. Gleich Jan. 1972 160 p refs
(Contract NAS3-12026)
(NASA-CR-72775; ARDE-46002) Avail: NTIS HC $10.00 CSCL 13K

High-cycle life ring-reinforced hemispherical type positive expulsion diaphragm performance was demonstrated by room temperature fluid expulsion tests of 13' diameter, 8 mil thick stainless steel configurations. A maximum of eleven (11) leak-free, fluid expulsions were achieved by a 25 deg cone angle diaphragm hoop-reinforced with .110-inch cross-sectional diameter wires. This represents a 70% improvement in diaphragm reversal cycle life compared to results previously obtained. The reversal tests confirmed analytic predictions for diaphragm cycle life increases due to increasing values of diaphragm cone angle, radius to thickness ratio and material strain to necking capacity. Practical fabrication techniques were demonstrated for forming close-tolerance, thin corrugated shells and for obtaining closely controlled reinforcing ring stiffness required to maximize diaphragm cycle life. A non-destructive inspection technique for monitoring large local shell bending strains was developed.
Author

N72-31497*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC FRICTION AND WEAR OF A SOLID FILM LUBRICANT DURING RADIATION EXPOSURE IN A NUCLEAR REACTOR
Thomas P. Jacobson Washington Sep. 1972 25 p refs
(NASA-TN-D-6940; E-6653) Avail: NTIS HC $3.00 CSCL 11H

The effect of nuclear reactor radiation on the performance of a solid film lubricant was studied. The film consisted of molybdenum disulfide and graphite in a sodium silicate binder. Radiation levels of fast neutrons (E> or = 1 MeV) were fluxed up to 3.5 times 10 to the 12th power n/sq cm-sec (intensity) and fluences up to 2 times 10 to the 18th power n/sq cm (total exposure). Coating wear lives were much shorter and friction coefficients higher in a high flux region of the reactor than in a low flux region. The amount of total exposure did not affect lubrication behavior as severely as the radiation intensity during sliding. Author

N72-31498*# Bendix Research Labs., Southfield, Mich.
DEVELOPMENT OF A SPACE QUALIFIED HIGH RELIABILITY ROTARY ACTUATOR. VOLUME 1: TECHNICAL REPORT Final Report, Feb. 1970 - Apr. 1972
R. W. Presley, R. G. Read, and N. L. Sikora May 1972 152 p
(Contract NAS5-21142)
(NASA-CR-122463; BRL-6048-Vol-1) Avail: NTIS HC $9.75 CSCL 13I

A space-qualified, high reliability, 150 ft-lb rated torque rotary acutator based on the Bendix Dynavector drive concept was developed. This drive is an integrated variable reluctance orbit motor-epicyclic transmission actuator. The performance goals were based on future control moment gyro torquer applications and represent a significant advancement in the torque-to-weight ratio, backlash, inertia and response characteristics of electric rotary drives. The program accomplishments have been in two areas: (1) the development of two high ratio (818:1) actuator configurations (breadboard and flightweight), and (2) the invention of a reliable proximity switch sensor system for self-commutation without use of optical or electrical brush techniques. Author

N72-31499*# Bendix Research Labs., Southfield, Mich.
DEVELOPMENT OF A SPACE QUALIFIED HIGH RELIABILITY ROTARY ACTUATOR FOR SPACEFLIGHT USE. VOLUME 2: APPENDICES TO TECHNICAL REPORT Final Report, Feb. 1970 - Apr. 1972
R. W. Presley, N. L. Sikora, and R. W. Presley Jun. 1972 87 p
(Contract NAS5-21142)
(NASA-CR-122470; BRL-6048-Vol-2) Avail: NTIS HC $6.50 CSCL 13I

A space-qualified, high reliability, 150 ft-lb rated torque rotary actuator is described. This drive is an integrated variable reluctance orbit motor-epicyclic transmission actuator. The performance goals were based on future control moment gyrotorquer applications and represent an advancement in the torque-to-weight ratio, backlash, inertia and response characteristics of electric rotary drives. The program accomplishments have been in two areas (1) the development of two high ratio (818:1) actuator configurations (breadboard and flightweight) and (2) the invention of a reliable proximity switch sensor system for self-commutation without use of optical or electrical brush techniques. Author

N72-31500# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
ANNUAL REPORT TO THE PERMANENT COMMITTEE OF THE GENERAL COUNCIL, 1971 [RAPPORT ANNUEL DU COMITE PERMANENT AU COUNSEIL GENERAL, 1971]
1972 45 p refs In FRENCH
Avail: NTIS HC $4.25

The main research work carried out in 1971 is described. This includes research on aluminum castings, welding, materials strength, numerical command of machine tools, and standardization. ESRO

N72-31501# Technische Univ., Berlin (West Germany). Sonderforschungsbereich Magnetohydrodynamik.
THEORY AND DESIGN OF THREE-LEGGED AC CONDUCTION PUMPS FOR LIQUID METALS [THEORIE UND BERECHNUG VON WECHSELSTROMKONDUKTIONS-PUMPEN FUER FLUESSIGE MATALLE IN DREISCHENKEL-KERN-BAUWEISE]
Tilo Schulz Jul. 1971 43 p refs In GERMAN; ENGLISH summary
(SFB-MHD-4) Avail: NTIS HC $4.25

Electromagnetic ac conduction pumps for liquid metals perform better in a three-legged core structure. The physical principles are described, beginning with the transformer with a leakage yoke. The secondary current crosses the pump channel, and the channel is magnetically excited by the leakage yoke. The current and magnetic field interact in the channel; these relationships are treated in detail and are shown in the vector diagram of the voltages, currents and magnetic fluxes. A simple design method was developed and applied to a small pump for a feed pressure of about 0.1 bar and a flow rate of 0.1 cu m/h. Possible improvements to this type of pump are mentioned. The

flux reducing effect of the armature reaction can be inverted by simple means, resulting in a tripling of output. ESRO

N72-31502# Louvain Univ. (Belgium). Inst. des Fabrications Mecaniques.
COMPARATIVE STUDY OF GRINDING AT CONSTANT FORCE AND CONSTANT SPEED DIPPING [COMPARAISON DE LA RECTIFICATION A FORCE ET A VITESSE DE PLONGEE CONSTANTES]
Albert Decneut (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric Metal. Jun. 1972 26 p refs In FRENCH Sponsored by IRSIA
(CRIF-MC-43) Copyright. Avail: NTIS HC $3.50

The application of grinding with constant load to external grinding, a process introduced for internal grinding instead of grinding with constant descent velocity, is discussed. Geometrical precision, surface finishing, time, and costs for external grinding with the new and the conventional processes are compared. It is concluded that although surface finishing is better, this method is not recommended for external grinding because wear of the grinding wheel is excessive and time is lost. ESRO

N72-31503# California Univ., Berkeley.
STUDY OF DEFORMATION AND DEFECTS OCCURRENCE IN ADVANCED FORGING TECHNIQUE Technical Report, Feb. - Dec. 1970
Shiro Kobayashi, S. Sohrabpour, and M. M. Sehgal Wright-Patterson AFB, Ohio AFML Sep. 1971 111 p refs
(Contract F33615-70-C-1320)
(AD-740887; AFML-TR-71-69) Avail: NTIS CSCL 13/8

A two-part investigation was performed to study the relationship between defects formation and deformation characteristics in plane-strain side-pressing and axisymmetric plastic indentation. In the first part, the investigation was undertaken to examine the detailed deformation characteristics involved in axisymmetric plastic indentation. Circular punches with flat and hemispherical ends were indented into specimens prepared from SAE 1215 steels under as-received and annealed conditions. In the second part, the detailed mechanics of the side-pressing of circular cylinders under plane-strain conditions were obtained, based on the observed flow patterns of commercially pure aluminum and copper specimens. Slip-line fields and corresponding hodographs were constructed, and stress calculations were made, taking into account the actual material properties. Author (GRA)

N72-31504# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WEARABILITY OF CERTAIN DETERGENT ADDITIVES AND THEIR COMPOSITIONS WITH ANTIOXIDANTS
A. B. Vipper and M. A. Lisovskaya 10 Apr. 1972 11 p refs Transl. into ENGLISH from Neftеperab. Neftekhim., Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb. (Kiev), no. 4, 1971 p 16-17 (Af Proj. 7343)
(AD-743120; FTD-HT-23-496-72) Avail: NTIS CSCL 11/8

The article examines the results of evaluating the wearability of detergent additives and compositions based on them with respect to the change in the efficiency of the detergent-and-dispersing action. The evaluation was conducted under laboratory conditions. Author (GRA)

N72-31505# Mechanical Technology, Inc., Latham, N.Y.
THE LAYER-SUBSTRATE INTERFACIAL STRESSES ARISING IN THE CYLINDRICAL CONTACT OF LAYER COVERED SURFACES
Eugene F. Finkin, Pradeep Gupta, and Jed A. Walowit Nov. 1971 66 p refs
(Contract N00014-70-C-0135; NR Proj. 062-317)
(AD-743122; MTI-71TR73) Avail: NTIS CSCL 13/9

To gain insight into materials selection and utilization criteria for gas bearings, a study was conducted of the stresses arising at the interface of layer-covered solids due to the application of normal and tangential forces. The influence of layer thickness and the relative mechanical properties of the layer and substrate were investigated. Design guidance, applicable to the broad range of coating covered surface used throughout mechanical engineering, in addition to the specific application of gas bearings, was derived from the stress analysis. Author (GRA)

N72-31506# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
THERMOELASTIC INSTABILITIES IN SLIDING CONTACT Final Report, 15 Apr. 1971 - 15 Apr. 1972
Ralph A. Burton and Thomas A. Dow 18 May 1972 96 p refs
(Contract N00014-67-A-0356-0022)
(AD-743117; Rept-5341-413) Avail: NTIS CSCL 11/1

Thermoelastic instability in rubbing contact is shown to be a consequence of the interaction of frictional heating, thermal expansion, conduction of heat from the contact zone, and wear. It manifests itself as a departure of the pressure distribution from a nominally uniform magnitude, as a result of the amplification of small disturbances. Such an instability is investigated here for two models of surface contact; (a) one-dimensional pin model and (b) two-dimensional blade model. The effects of materials, friction coefficients, severity of wear and sliding speed are delineated with respect to disturbance amplification or damping. The long-term growth of a disturbance is described and the resulting hot spot motion is explained. Author (GRA)

N72-31507# Pratt and Whitney Aircraft, East Hartford, Conn.
JOINING TECHNIQUES FOR FABRICATION OF HIGH-TEMPERATURE SUPERALLOY BLADES Final Report, 1 Jul. - 30 Sep. 1971
C. G. Nessler Wright-Patterson AFB, Ohio AFML Dec. 1971 129 p refs
(Contract F33615-70-C-1784)
(AD-743107; PWA-4333) Avail: NTIS CSCL 13/8

Three diffusion welding systems were evaluated for applicability to the fabrication of advanced design air-cooled gas turbine blades from split halves. The joining systems evaluated were based upon the use of interlayers to promote and enhance diffusion welding of the directionally solidified superalloy (modification of MARM-200) used for this program. Particular emphasis was placed on increasing the ability of the joining systems to accommodate lack of fit which is a major concern in diffusion welding complex-shaped hollow parts. Author (GRA)

N72-31508# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MULTILAYERED BOUNDARY SURFACE FILMS IN COLD PRESSURE WORKING OF METALS
A. P. Chekmarev, V. I. Meleshko, A. P. Kachailov, and S. D. Adamskii 3 Apr. 1972 19 p refs Transl. into ENGLISH from Prokatnoe Proizvodstvo (USSR), v. 34, 1970 p 90-99
(AF Proj. 7343)
(AD-742686; FTD-HC-23-1840-71) Avail: NTIS CSCL 13/8

The external friction mechanism at the instrument processed metal contact point in cold treatment of the metal by pressure is discussed. A treatment of this mechanism as the combined action of multilayer bounding films formed as the result of physical and chemical interactions of the contacting surfaces with the applied lubrication, depending on specific deformation conditions, is considered. Author (GRA)

N72-31509# Terra-Space, Inc., Bethesda, Md.
DESIGN AND FABRICATION OF EXPONENTIAL NOZZLE Final Report, Jan. 1971 - Mar. 1972
William C. Cooley and Paul E. Brockert Apr. 1972 19 p refs
(Contract BM-HO-210012; ARPA Order 1579)
(AD-742452; TR-4033) Avail: NTIS CSCL 13/11

The report covers the design and manufacture of an

exponential nozzle which is intended for use in experiments on the breakage of rock by high pressure pulsed water jets. The nozzle as-built is calculated to be able to withstand an internal maximum pressure of 170,000 psi and to be able to produce water jet stagnation pressures up to 680,000 psi through a 6.05 mm (0.238 inch) exit diameter. Author (GRA)

N72-31510# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRODUCTION OF MONOLITHIC PANELS FROM ALUMINUM ALLOYS
M. Z. Ermanok and Yu. N. Aleksandrov 14 Mar. 1972 277 p refs Transl. into ENGLISH of "Proizvodstvo Monolithnykh paneley iz Alyuminiyevykh Splavov" 1969 p 1-216
(Contract F33657-71-D-0057)
(AD-742779; FTD-HC-23-725-71) Avail: NTIS CSCL 13/8

The effectiveness of using extruded monolithic panels in different areas of technology is investigated. The methods of extruding panels are analyzed, and the variety of panels is determined. The procedure for calculating multilayer stresses in containers and extrusion equipment has been given. The fundamental problems of the technology of straightening extruded panels are investigated. A description is given of modern furnishing equipment, modern furnaces for thermal treatment of panels, and also the technology of thermal treatment. The results of investigating the structure and properties of panels, as well as their geometry, are given. Author (GRA)

N72-31511# Chalmers Univ. of Technology, Goteborg (Sweden). Div. of Machine Elements.
THE PLANE PAD BEARING OF INFINITE WIDTH CONSIDERING VARIABLE VISCOSITY ALONG, AS WELL AS ACROSS, THE FLUID FILM, 1. THE SECTOR THRUST BEARING CONSIDERING VARIABLE VISCOSITY
Jan Stromberg Stockholm 1971 125 p refs
(PB-209202; APS-ME-59) Avail: NTIS; HC Acta Polytechnica Scandinvica Publishing Office, Box 5073, S-102 42 Stockholm 5 (Sweden) Sw. Kr. 20.00 CSCL 11H

Adiabatic conditions, with variations in the viscosity of the oil due to the temperature and the pressure of the oil are examined. In two cases the heat transfer to the moving solid is considered showing small deviations from the corresponding adiabatic case. The viscosity field is 2-dimensional and solutions are given for different pad inclinations, different non-dimensional viscosity-temperature coefficiencts, and different non-dimensional thermal conductivity coefficients of the oil. The second report considers adiabatic conditions with variations in the viscosity of the oil due to the temperature and the pressure in the oil film. The temperature variation across the oil film is neglected but the error in the load capacity due to this is estimated. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-31512*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RESEARCH AND DEVELOPMENT FOR A GROUND-BASED HYDROGEN-MASER SYSTEM Final Report
Apr. 1972 126 p refs
(Contract NSR-09-015-098)
(NASA-CR-128050; Rept-204-102) Avail: NTIS HC $8.50 CSCL 20E

The results of a joint experiment aimed primarily at the determination of the frequency of the H(1) hyperfine transition are reported. The transition frequency value for Cs-133 hyperfine transition is found. The result is the mean of two independent evaluations against the cesium reference, which differ by 0.002 Hz. The one-sigma uncertainty of the value nu sub H is also estimated to be 0.002 Hz. One evaluation is based on wall shift experiments at Harvard University; the other is a result of new wall shift measurement using many storage bulbs of different sizes at the National Bureau of Standards. The experimental procedures and the applied corrections are described. Results for the wall shift and for the frequency of hydrogen are compared with previously published values, and error limits of the experiments are discussed. Author

N72-31513# Communications Research Centre, Ottawa (Ontario).
A TECHNIQUE FOR THE MEASUREMENT OF FLUORESCENCE LIFETIMES WITH AN OPTICALLY CHOPPED LASER BEAM
A. Watanabe and J. G. Chambers Jun. 1972 6 p refs
(CRC-TN-642) Avail: NTIS HC $3.00

A technique was developed for generating a train of short pulses from the output of a laser. It is shown that this technique can be used to produce variable length pulses with well defined shapes which are suited to the measurement of fluorescence lifetime in a wide range of materials. Author

N72-31514# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE DEVELOPMENT OF A LASER FLUOROSENSOR FOR REMOTE ENVIRONMENTAL PROBING
R. M. Measures and M. Bristow [1970] 7 p refs
Avail: NTIS HC $3.00

The first phase of a development program devoted to the exploitation of laser induced fluorescence for environmental sensing is presented. A prototype laser fluorosensor was constructed and used to evaluate, in the laboratory, the feasibility of this concept and to explore the potential range of applications. Special attention was given to assessing the ability of a laser fluorosensor to map the extent of an oil slick, locate the source of lignin sulphonate pollution, and monitor the dispersal of a tracer dye for hydrologic uses. The preliminary results of the study are encouraging. Author

N72-31515*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR CHECKING THE STABILITY OF A SETUP FOR MAKING REFLECTION TYPE HOLOGRAMS Patent Application
Helmut G. Lackner, inventor (to NASA) Filed 18 Aug. 1972 9 p
(NASA-Case-MFS-21455-1; US-Patent-Appl-SN-281877) Avail: NTIS HC $3.00 CSCL 20E

A method and apparatus are presented for checking the stability of a setup for recording reflection-type (white light) holograms. Two sets of interference fringes are simultaneously obtained, one giving information about coherence and stability of the setup alone, and the other demonstrating coherence of the entire system, including the holographic recording plate. Special emphasis is given to the stability of the plate, any minute vibrations of which may severely degrade or completely destroy the recording. NASA

N72-31516*# California Univ., Los Angeles. Plasma Physics Group.
LASER AMPLIFICATION IN AN INHOMOGENEOUS PLASMA
Roscoe B. White Jan. 1972 12 p refs Submitted for publication
(Grants NGR-05-007-190; NGR-05-007-116; NSF GP-22817; Proj. 157; Contracts N00014-69-A-0200-4023; At(04-3)-34; Grants NSF GP-22817; Proj. 157y)
(NASA-CR-122467; PPG-109) Avail: NTIS HC $3.00 CSCL 20E

The propagation of an electromagnetic wave into an inhomogeneous plasma was studied. In a plasma with large density gradients a QTX mode propagating perpendicular to the

magnetic field can encounter a resonance and a cutoff separated by a distance comparable to the incident wave length. In this region the wave is evanescent, and in general there will be a reflected and transmitted wave, and amplification will occur in the region near the resonance. The amplification is important for the study of nonlinear phenomena and for feedback stabilization applications. Author

N72-31517# Institut Franco-Allemand de Recherches, St. Louis (France).
UTILIZATION OF THE GABOR ARRANGEMENT IN MICROHOLOGRAPHY [L'UTILISATION DU MONTAGE DE GABOR EN MICROHOLOGRAPHIE]
H. Royer and F. Albe 12 Nov. 1971 27 p refs In FRENCH Sponsored by Centre d'Essais de Propulseurs
(ISL-34/71) Avail: NTIS HC $3.50

It is shown that it is possible to achieve holographic image restitution with a given enlargement by using the Gabor mounting. The optical path between the image and its object is calculated. Ways of reducing the aberrations are proposed, such as compensating for the spherical aberration by using the Gabor mounting geometry. ESRO

N72-31518# Institut Franco-Allemand de Recherches, St. Louis (France).
DIAGNOSTICS OF TURBULENCE. PART 2: OPTO-ELECTRONIC METHOD USING CONTINUOUS LASER BEAM [DIAGNOSTIC DES TURBULENCES. 2EME PARTIE: METHODE OPTO ELECTRONIQUE PAR FAISCEAU LASER CONTINU]
B. Koch, H. J. Pfeifer, G. Smeets, and H. D. VomStein 15 Nov. 1971 17 p In FRENCH Presented at the 8th Assoc. Franc. des Ingr. et Techniciens de l'Aeron. et de l'Espace Colloq. on Aerodynamique Appl., St. Louis, France, 8-10 Nov. 1971
(ISL-39/71-Pt-2) Avail: NTIS HC $3.00

Two methods for the investigation of slow and turbulence, which are based on the laser beam opto-electronic method, are described. They include the single beam and double beam techniques. ESRO

N72-31519# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
PROPAGATION AND TRANSMISSION OF LASER BEAMS IN THE ATMOSPHERE [AUSBREITUNG UND UEBERTRAGUNG VON LASERSTRAHLEN IN DER ATMOSPHAEHRE]
R. Gruss Jan. 1971 21 p refs In GERMAN Presented at the NTG-Diskussionssitzung Nachrichtenuebertragung mit Laser, Munich, 19-20 Nov. 1970
(FTZ-A-465-TBr-6) Avail: NTIS HC $3.25

Atmospheric laser beam propagation and transmission is discussed, and results of experiments are reported. It is shown that the atmosphere is an interference-susceptible optical transmission channel. For applications, optimal transmission distances between 3 and 5 km may be used, but to assure a continuous operation laser outputs of 10 watts or more are necessary. Apart from space applications, limited laser radio relay systems in telecommunication and future data networks seem possible. ESRO

N72-31520# Westinghouse Electric Corp., Pittsburgh, Pa.
TRIATOMIC CENTROSYMMETRIC CRYSTALS Final Report, 1 Apr. 1971 - 31 Mar. 1972
George W. Roland, Thelma J. Isaacs, Kenneth B. Steinbruegge, Robert Mazelsky, Martin Rubenstein, and Andrea Price 31 May 1972 33 p refs
(Contract N00014-71-C-0267; NR Proj. 017-733)
(AD-743115; Rept-72-9J8-WIMAT-R1) Avail: NTIS CSCL 20/5

A large number of sulfosalt compounds was investigated to determine the usefulness of such materials as infrared window materials, particularly at 10.6 micrometers. Polycrystalline synthesis were followed in a few instances by crystal-growth experiments and determination of absorption coefficients. Of the many materials examined, TlInS2, TlGaSe2, and TlAsSe3 show most promise as window materials; in fact, the best measured absorption coefficient for Tl3AsSe3 (0.016/cm) is the lowest ever measured on a material of this type. Particularly for Tl3AsSe3, it propagation through the crystal. Author (GRA)

N72-31521# RAND Corp., Santa Monica, Calif.
DIFFRACTION PATTERNS PRODUCED BY FOCUSED LASER BEAMS
J. H. Rosen Apr. 1972 49 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-742754; R-925-ARPA) Avail: NTIS CSCL 20/5

An investigation is made of diffraction and jitter--two factors that influence the energy density produced by a laser beam projected from an aperture and focused onto a distant surface. The report first examines the characteristics of diffraction patterns produced by circular apertures with circular central obscurations and gaussian illuminations. Formulas, tables, and graphs are presented that enable the reader to estimate the peak intensity, the spot size, the power within the spot, and the average intensity over the spot that can be achieved by a given laser/telescope system. Attention is then directed to the problem of estimating energy densities when the center of the diffraction pattern jitters about an aim point on the target. A method is presented for estimating the effect of jitter that depends, in part, on approximating a real diffraction pattern with a gaussian pattern. Author (GRA)

N72-31522# General Telephone and Electronics Labs., Inc., Bayside, N.Y.
TUNABLE CW DYE LASER Annual Technical Summary Report, 1 Feb. 1971 - 31 Jan. 1972
A. Lempicki, H. Samelson, and R. Jacobs 1 Apr. 1972 48 p refs
(Contract DAHC04-71-C-0012; DA Proj. 2O0-61102-B-11B)
(AD-742737; GT/E-TR-72-840.1; AROD-9422-1-P) Avail: NTIS CSCL 20/5

Work on the CW dye laser is presented in detail. The main objectives of designing a stable, damage resistant and tunable cell and resonator, setting up a theoretical model for the laser dynamics, and performing experiments leading to a verification of the model have been accomplished. All these aspects are discussed in detail. The final design adopted was a spherical resonator with a cell having thick lenslike windows. The factors influencing the choices made are presented, and the final proof is the achievement of long term, reproducible performance. Author (GRA)

N72-31523# ILC, Inc., Sunnyvale, Calif.
OPTICAL PUMPS FOR LASERS Triannual Report no. 1, 17 May - 17 Sep. 1971
Lowell Noble and Carl B. Kretschmer Mar. 1972 62 p refs
(Contract DAAB07-71-C-0239)
(AD-742734; R-ILC-71-30; ECOM-0239-1) Avail: NTIS CSCL 20/5

The objective of the program is to increase both the output efficiency and the reproducibility of optical pumps for Nd:YAG lasers. Lamps with quartz envelopes dopes with cerium, which converts ultra violet radiation to visible radiation, have been tested and found to emit 15% more light in the region between 0.4 and 0.65 micrometers than lamps made of undoped quartz. An analysis was made of the externally triggered mode and simmer mode of flashlamp operation. A technique was devised to measure lamp arc growth during a pulse. A lamp of 4 mm bore diameter and 2.125 inch arc length, filled with 450 Torr of xenon, required a 20 joule pulse to fill the bore within a 100 microseconds period. Lamps have been manufactured to tolerances significantly tighter than normal; they may provide more reproducible light output than is provided by standard lamps. Author (GRA)

N72-31524# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
SATURABLE ABSORBING MATERIALS FOR Q-SWITCHING NEODYMIUM LASERS Final Report, 1 Feb. 1971 - 31 Jan. 1972
Hai-men Lo May 1972 55 p refs
(Contract DAAB07-71-C-0122; DA Proj. 1H6-62705-A-056)
(AD-742730; ECOM-0122-F) Avail: NTIS CSCL 20/5

The report describes investigative work performed on IBM proprietary dye 106-5 for Q-switching neodymium lasers. This dye was used in solution form to Q-switch a neodymium glass laser to deliver a peak power of over 100 megawatts in approximately 20 nanoseconds and in plastic thin film form to Q-switch a flashlamp pumped neodymium-yttrium aluminum garnet (Nd:YAG) laser to deliver a peak power of over 3 megawatts with a 15 nonoseconds pulsewidth. A plastic thin film with liquid cooling also proved to be useful in Q-switching a multiple pulse Nd:YAG laser. The selection of solvents and solid host materials for this dye, as well as the construction of the liquid-dye cell and the plastic-dye film, are discussed. Results on durability and temperature stability tests for both the dye solution and the plastic-dye film are also included. Based on the present results, design recommendations are made for improving the performance of the Q-switch dye in a solution form, as well as in a solid matrix. Author (GRA)

N72-31525# Physics International Co., San Leandro, Calif.
INVESTIGATION OF PULSED COLD CATHODE ELECTRON GUNS FOR USE AS A LASER DISCHARGE SUSTAINER Final Report, Apr. - Oct. 1971
Gary Loda and Terrance Dehart May 1972 86 p refs
(Contract DASA01-71-C-0111)
(AD-742841; PIFR-326; DNA-2777F) Avail: NTIS CSCL 09/1

A study has been undertaken to construct and investigate cold cathode electron guns in the range of 1 to 10 A/sq. cm. for eventual use as laser discharge sustainers. Measurements have been made on impedance characteristics, pulse durations, and beam uniformity. Emission mechanisms have been proposed and a relation between impedance and space charge limited flow has been established. Limitations in pulse duration have been defined. Uniformity results from photographs of beam-produced bremsstrahlung are presented. Application of such a device as a discharge sustainer is discussed. Author (GRA)

N72-31526# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.
NEUTRON INITIATED CHEMICAL LASER EXPERIMENTS
Thomas G. Miller and George J. Dezenberg 18 Feb. 1972 25 p refs
(DA Proj. 1T6-62705-A-308)
(AD-743876; RR-TR-72-2) Avail: NTIS CSCL 20/5

235 UF6H2 and F2H23He gas mixtures were irradiated with a pulsed neutron source. No HF lasing was observed, but it was shown that HF could be produced. The maximum HF produced was approximately equal to 50-70% of the initial 235 UF6 concentration. Author (GRA)

N72-31527# Raytheon Co., Waltham, Mass. Research Div.
INFRARED LASER MATERIALS Final Technical Report, 15 Mar. 1971 - 14 Mar. 1972
Andrew D. Morrison and Roch R. Monchamp Jun. 1972 73 p refs
(Contract DAAB07-71-C-0150; DA Proj. 1H6-62705-A-056)
(AD-743223; S-1424; ECOM-0150-F) Avail: NTIS CSCL 20/5

Neodymium-doped yttrium orthoaluminate is investigated for use as a high-efficiency optically-pumped infrared laser material. The growth of high optical quality crystals was studied and growth parameters including pull and rotation rates, atmosphere, thermal ambients, and annealing are discussed. Measurements of hardness, the distribution coefficient of Nd(3+) in YAlO3, dopant inhomogeneities, the presence of scattering sites, and the tube effect are described. Effects of increasing the Nd(3+) concentration and possible sensitizer ions for Nd(3+), including cerium, vanadium, and chromium, are considered. Optical spectra of Ce(3+)YAlO3 and measurements of the rate and efficiency of Cr(3+) yields Nd(3+) energy transfer are presented. Laser rods containing 1, 2, and 3 percent Nd(3+) and Nd(3+) sensitized with Cr(3+) were prepared and tested in long-pulse, Q-switched, and CW laser operation. The results from these b-axis NdYAlO3 rods are compared with those obtained from NdYAG rods. Author (GRA)

N72-31528# Naval Underwater Systems Center, Newport, R.I. Sonar Technology Dept.
DOUBLE PULSED HOLOGRAPHIC INTERFEROMETRY
Peter Shajenko 30 Mar. 1972 47 p refs
(AD-742793; NUSC-4191) Avail: NTIS CSCL 14/2

Performance capabilities of an improved ruby laser with Q-switched double-pulsed output as applied to holographic interferometry were investigated. The basic criteria leading to mode selection and the mode selection technique are described. A ruby laser with a pulse duration in the order of 20 nanoseconds and coherence length of one meter was applied to vibration and shock studies of a number of mechanical structures including thin and thick plates, a loudspeaker, a transducer housing, and a long cylindrical rod. Author (GRA)

N72-31529# Naval Postgraduate School, Monterey, Calif.
DENSITY INHOMOGENEITY IN A LASER CAVITY DUE TO ENERGY RELEASE
Allen E. Fuhs May 1972 12 p refs
(AD-743051; NPS-57FU72051A) Avail: NTIS CSCL 20/5

Density gradients, which refract laser light within the cavity, degrade beam quality. In addition to wall influences and viscous effects which cause density gradients, there is another mechanism. This mechanism, which is due to wakes and compression waves from heat (vibration energy to translation and rotation) addition in a supersonic stream, appears to have been overlooked. This appropriate equation is stated and discussed. A semigraphical solution procedure is outlined. Contours of constant density have been calculated for circular and rectangular cavities. Graphs of the isodensity contours are given. Author (GRA)

N72-31530# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
GAIN SATURATION IN A LASER AMPLIFIER DRIVEN BY A CW OSCILLATOR Report for Mar. - Jun. 1971
George Emanuel 15 May 1972 33 p refs
(Contract F04701-71-C-0172)
(AD-742978; TR-0172(2753)-1; SAMSO-TR-72-91) Avail: NTIS CSCL 20/5

A model is given for a cw oscillator driving an amplifier whose upper excited level is pumped instantaneously, continuously, or both. Although simple, this model includes the nonlinear effect of gain saturation. Closed-form solutions for the intensity are obtained for all times including an initial transient period. When initial pumping occurs, first derivatives are discontinuous across a characteristic emanating from the origin. Examples are presented that illustrate the dominant effect of gain saturation. Author (GRA)

N72-31531# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE MUTUAL COHERENCE FUNCTION OF A FINITE CROSS SECTION OPTICAL BEAM PROPAGATING IN A TURBULENT MEDIUM Technical Report, Jul. - Aug. 1971
H. T. Yura 12 May 1972 39 p refs
(Contract F04701-71-C-0172)
(AD-742983; TR-0172(9230-10)-7; SAMSO-TR-72-120) Avail: NTIS CSCL 20/6

On the basis of the extended Huygens-Fresnel principle, a general expression is derived for the mutual coherence function (MCF) of a finite optical beam propagating in a weakly inhomogeneous medium. The results obtained for the beam MCF are valid both in the near and far field of the laser transmitting

aperture and for an arbitrary complex disturbance in the exit pupil of the aperture. A general expression is also derived for the propagation distance z(B) such that for distances much less (greater) than z(B), the MCF is well approximated by the plane (spherical) wave results. An analytic expression is presented for a Gaussian beam such that a numerical error in previous results is corrected. Finally, some comments regarding higher-order statistical moments of the field are given. Author (GRA)

N72-31532# Hughes Research Labs., Malibu, Calif.
A 10.6 MICRON LASER COMMUNICATION SYSTEM Semiannual Technical Report, 1 Sep. 1971 - 31 Mar. 1972
F. E. Goodwin, T. A. Nussmeier, and J. H. Morse Apr. 1972 92 p refs
(Contract DAAB07-72-C-0051)
(AD-742728; ECOM-0051-1) Avail: NTIS CSCL 17/2

This report summarizes work performed under the contract from September 1971 through March 1972, the first half of a one-year effort to design, fabricate, and test an experimental 10.6 micrometer laser communication system. The system consists of a transmitting terminal and a receiving terminal which provides a simplex 5 Mbit/sec data channel over a five-mile terrestrial path with an error rate of 0.000001 in all but the most severe weather conditions. The system uses intracavity electro-optic modulation with a frequency shift keying format and optical FM heterodyne detection using a mercury-cadmium-telluride (HgCdTe) detector operating at 77K. The details of the system design and predicted performance in rain and fog are given. Author (GRA)

N72-31533# Aerospace Corp., El Segundo, Calif.
PERFORMANCE OF cw HF CHEMICAL LASER WITH N2 OR He DILUENT
Donald J. Spencer, Harold Mirels, and Donald A. Durran Nov. 1971 7 p refs Repr. from J. Appl. Phys., v. 43, no. 3, Mar. 1972 p 1151-1157
(Contract F04701-71-C-0172)
(AD-742962) Avail: NTIS CSCL 20/5

Recent experimental results on the performance of a continuous HF (or DF) chemical laser are reported. In this device, an arc-heated diluent is mixed in a plenum with SF6 to provide F atoms. The mixture is expanded to form a supersonic jet into which H2 (or D2) is diffused. The variation of laser power and efficiency with cavity optical axis location and SF6 mass flow are reported for both N2 and HE systems. A spectrum of the HF laser operating in a He flow is also presented that gives evidence of v 3 partial inversion. Author (GRA)

N72-31534# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics
EXPLORATION OF GAS LASER APPLICATIONS IN THE INFRARED AND VISIBLE RANGE Final Report, 1 Jan. 1970 - 31 Aug. 1971
Ali Javan 15 Dec. 1971 22 p refs
(Contract F19628-70-C-0150)
(AD-744066; AFCRL-72-0011) Avail: NTIS CSCL 20/5

The report briefly describes the author's laser and quantum electronics research including further development of high speed infrared point contact tunneling mixer-rectifier diodes, excitation and relaxation studies in molecular laser systems, coherent effects in short pulse propagation, laser-induced line-narrowing effects and their applications, and the development and application of techniques for precision infrared spectroscopy. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-31535*# Western Applied Research and Development, Inc., San Carlos, Calif.
MATERIALS DATA HANDBOOK: ALUMINUM ALLOY 2014, 2ND EDITION
R. F. Muraca and J. S. Whittick May 1972 128 p refs Revised
(Contract NAS8-26644)
(NASA-CR-123779) Avail: NTIS HC $8.50 CSCL 11F

A revised edition of the materials data handbook on the aluminum alloy 2014 is presented. The scope of the information presented includes physical and mechanical property data at cryogenic, ambient and elevated temperatures, supplemented with useful information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication and joining techniques. Design data are presented, as available, and these data are complemented with information on the typical behavior of the alloy. Author

N72-31536# Aeronautical Research Labs., Melbourne (Australia).
SOLID-SOLUTION HARDENING IN COPPER-BASE ALLOYS
M. M. Hutchinson and R. T. Pascoe Sep. 1971 80 p refs
(ARL/MET-Rept-85) Avail: NTIS HC $6.00

Solid solution hardening was examined in a wide range of polycrystalline copper-base alloys using the resistance to tensile deformation to determine the influence of the various solutes. Consideration of possible parameters showed that the best relative measure of solute strengthening was the flow stress after some small strain; 1% strain was chosen in the present instance, thus avoiding the direct comparison of a flow stress for inhomogeneous deformation with one for homogeneous deformation. The resistance of grain boundaries to deformation varies both with type and concentration of solute. The value of n was found to be 1 for these alloys, while K was primarily controlled by the shear modulus of the alloy. Strain hardening in the alloys resulted mainly from an increase in sigma sub zero, with little change in K. In general, K decreased with strain, although sometimes an initial slight increase was found. The relationship between stress and grain size, the observed variation in sigma sub zero and K with strain, and the value of n = 1 can be understood by an extension of the Li model involving the generation of dislocation at grain boundary ledges. Author

N72-31537# Aeronautical Research Labs., Melbourne (Australia).
THE INFLUENCE OF MEAN STRESS AND STRESS CONCENTRATORS ON THE FATIGUE PROPERTIES OF 7178-T6 ALUMINIUM ALLOY
J. Y. Mann Nov. 1970 70 p refs
(ARL/SM-327) Avail: NTIS HC $5.50

An investigation, involving twenty different notch severity/mean stress combinations, was made of the unnotched and notched axial load fatigue properties of extruded 7178-T6 aluminium alloy under different tensile mean stresses. The notched specimens tested had stress concentration factors of 1.6, 3.3, 5.5, 10, and more than 30. Author

N72-31538# Helsinki Univ. of Technology, Otaniemi (Finland).
THE RESIDUAL STRESSES IN CARBURIZED LAYERS ON AN UNALLOYED AND A MOLYBDENUM CHROMIUM ALLOYED STEEL AFTER VARIOUS HEAT TREATMENTS [DIE EIGENSPANNUNGEN IN DEN AUFGEKOHLTEN SCHICHTEN BEI EINEM UNLEGIERTEN UND EINEM Mo-Cr-LEGIERTEN EINSATZSTAHL NACH VERCHIEDENEN

WAERMEBEHANDLUNGEN]
L. Salonen 1972 28 p refs In GERMAN
(Ch-109) Avail: NTIS HC $3.50

Steel samples with dimensions of 7x7x75 mm, 13x13x100 mm, 24x24x125 mm, and 45x45x175 mm underwent carburization and various heat treatments. Hardening-depth-curves and residual stress measurements were obtained. It is shown that heat treatment variables did not markedly effect residual stress components in the molybdenum chromium steel; but hardening decreased residual pressure at surfaces and shifted maximal residual pressure to a deeper zone with a carbon content of 0.6 percent. Transl. by G.G.

N72-31539# Joint Publications Research Service, Arlington, Va.
METALLURGY OF ALLOYS AND HIGH TEMPERATURES
17 Aug. 1972 60 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 3, May-Jun. 1972 p 162-165, 190-193, 206-223, and 240-251
(JPRS-56794) Avail: NTIS HC $5.00

The microstructure and physical and mechanical properties of heat resistant alloys are investigated. High temperature effects on ternary alloys are also examined. For individual titles, see N72-31540 through N72-31547.

N72-31540 Joint Publications Research Service, Arlington, Va.
DISTINCTIVE FEATURES OF RECRYSTALLIZATION IN HIGH-TEMPERATURE ALLOY CrNi77TiAlB
L. S. Yershova *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 1-5 refs (For availability see N72-31539 22-17)

The microstructure of CrNi77TiAlB after hardening or hardening with aging was found to consist of grains of gamma solid solution. The metallographic change of the intragranular substructure of the deformed alloy, as a function of annealing temperature, was compared with changes of mean value of the disorientation angle. X-ray diffraction was used for analysis. The recrystallization proceeded through dislocation redistribution in the small angle boundaries with subsequent migration into the high angle boundaries. J.A.M.

N72-31541 Joint Publications Research Service, Arlington, Va.
THE INFLUENCE OF SMELTING SLAG ON THE HIGH-TEMPERATURE PLASTICITY OF ALLOY Cr20Ni80
B. V. Oshchepkov, K. K. Burnakov, I. S. Khokhlov, and V. P. Vypryazhkin *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 6-11 refs (For availability see N72-31539 22-17)

Compositional effects of smelting slag on nonmetallic film inclusion formation and on high temperature plasticity of Cr20Ni80 were studied. The thick slags with MgO content were found to contribute to inclusion formation. J.A.M.

N72-31542 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF TRANSFORMATIONS IN THE SYSTEM Fe-Ni-Al
L. A. Kucherenko and V. A. Troshkina *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 12-19 refs (For availability see N72-31539 22-17)

Transformations in hardened alloyed melts of the Fe-Ni-Al system were studied, using heat capacity and electrical resistance. Heat capacity was measured every 1-2 deg in the temperature range 20-650 C, using a continuous adiabatic heating method in a calorimeter. During annealing, quenched alloys undergo two exothermic transformations, low temperature in the 300-500 C range and high temperature in the region of 550-650 C. J.A.M.

N72-31543 Joint Publications Research Service, Arlington, Va.
PHASE FIELD BOUNDARIES IN THE SYSTEM W-Ta-Ti AT 1600 C
Z. I. Tolmacheva and V. I. Kornilova *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 20-25 refs (For availability see N72-31539 22-17)

The structure of W-Ta-Ti alloys was studied to determine the boundaries of homogeneity of ternary solid solutions at 1600 C. Based on metallographic and roentgenographic investigations, an isothermic section of the W-Ta-Ti system was constructed, as well as approximate projection of liquid and solid surfaces on a concentration triangle. J.A.M.

N72-31544 Joint Publications Research Service, Arlington, Va.
THE INFLUENCE OF MOLYBDENUM AND TUNGSTEN ON THE PROPERTIES OF Ni-Cr-Nb ALLOYS
G. A. Sveshnikova and A. M. Borzdyka *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 26-31 refs (For availability see N72-31539 22-17)

The Ni-Cr-Nb alloys were smelted in a 30 kg induction furnace at a residual pressure of 5mm Hg. The metal was cast by the open method into 7 kg bars; the chemical composition of the alloys is cited. Heat resistance was increased through the introduction of Mo and W jointly into Ni-Cr-Nb, while solubility of Nb in Ni-Cr solid solution at 700-900 C was decreased. J.A.M.

N72-31545 Joint Publications Research Service, Arlington, Va.
KINETICS OF SOLID-PHASE REACTIONS IN THE SYSTEMS Ta-Be-Zr AND Nb-Be-Zr
A. S. Panov and M. M. Rysina *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 32-38 refs (For availability see N72-31539 22-17)

At 900-1400 C, solid phase reactions between intermetallic compound ZrBe13, Ta, and Nb are studied, using metallograpic, microdurometric, and X-ray analysis. The limiting stage of the growth process of Be layers was found to be diffusion. J.A.M.

N72-31546 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF THE CONTACT PROPERTIES OF Ni-C AND Co-C FUSIONS WITH GRAPHITE **c18**
Yu. V. Naydich, V. M. Pervertaylo, and G. M. Nevodnik *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 39-45 refs (For availability see N72-31539 22-17)

The wettability was investigated in systems of graphite-Ni-C or Co-C fusions as function of the C concentration in liquid phases, varying from 0 to the equilibrium concentration. The wettability was found to be higher in a nonequilibrium than in an equilibrium contact system. The experimental procedures and results are described. J.A.M.

N72-31547 Joint Publications Research Service, Arlington, Va.
THE MECHANISM OF DEVELOPMENT OF GASEOUS POROSITY IN SOLID METALS
Ya. B. Ulanovskiy and A. A. Zhukhovitskiy *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 46-57 refs (For availability see N72-31539 22-17)

Qualitative treatment of the kinetics of growth of gaseous porosity is shown. The proposed gas porosity theory in aluminum is compared to varied schemes. Graphs of temperature dependence effects are also included. J.A.M.

N72-31548*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TESTING FOR HYDROGEN EMBRITTLEMENT: PRIMARY AND SECONDARY INFLUENCES
Howard G. Nelson Aug. 1972 33 p refs
(NASA-TM-X-62173) Avail: NTIS HC $3.75 CSCL 11F

An overview is presented of the hydrogen embrittlement process, both internal as well as external, to make more clear the type of parameters which must be considered in the selection of a test method and test procedure, so that the resulting data may be meaningfully applied to real engineering structures. Three primary influences on the embrittlement process are considered: (1) the original location and form of the hydrogen, (2) the transport reactions involved in the transport of hydrogen from its origin to some point where it can interact with the metal to cause embrittlement, and (3) the embrittlement

interaction itself. A few secondary influences on the embrittlement process are also discussed. Author

N72-31549# British Iron and Steel Research Association, London (England). Metallurgy Dept.
AN ASSESSMENT OF THE PERFORMANCE OF FUSION AND NEUTRON ACTIVATION TECHNIQUES FOR OXYGEN DETERMINATION IN STEEL
D. Booth, F. Cooke, and P. H. Scholes 1970 11 p refs
(MG/D/646/70) Avail: NTIS HC $3.00

Two oxygen reference steels were made and used by six laboratories in a statistically planned trial to assess the analytical performance of reducing fusion techniques at 50 and 200 x .0001 weight per cent oxygen levels. Laboratory agreement is good and compares very favourably with that obtained in similar trials in the U.S.A. and on the continent. It was not possible to make a valid comparison with neutron activation techniques because the sample size used in the trial proved, in practice, to be unsuitable for the activation units available. Author

N72-31550# Technische Univ., Berlin (West Germany).
A NEW MECHANISM AND ITS EXPERIMENTAL PROOF FOR THE EFFECT OF BATH ADDITIVES ON CURRENT DENSITY DISTRIBUTION DURING METAL DEPOSITION ON ROUGH CATHODES Ph.D. Thesis [EIN NEUER MECHANISMUS DES EINFLUSSES VON BADZUSAETZEN AUF DIE STROMDICHTEVERTEILUANG BEI DER METALLABSCHEIDUNG AUF RAUHEN KATHODEN UND SEINE EXPERIMENTELLE BEGRUENDUNG]
Juergen Schulz-Harder 1971 127 p refs In GERMAN
Avail: NTIS HC $8.50

A dynamic surface deposition model is formulated and used to determine the effects of additives in acid copper sulfate electrolytes on the smoothing capacity in cathodic electrodeposition. It is shown that increased deposition velocities in surface depressions result from higher surface concentrations of a catalytic effective adsorbing substance; deposition increases with pit smoothing are thus explained by geometric surface reductions during metal deposition controlled by catalytic effective additives. Transl. by G.G.

N72-31551*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED THERMOCHEMISTRY OF OXYGEN IN LITHIUM AND SODIUM FOR LIQUID METAL COOLING SYSTEMS
Leonard K. Tower Washington Sep. 1972 23 p refs
(NASA-TM-X-2636; E-7021) Avail: NTIS HC $3.00 CSCL 11F

Plots of oxygen chemical potential against composition of lithium-oxygen solutions and sodium-oxygen solutions for a range of temperature were constructed. For each liquid metal two such plots were prepared. For one plot ideal solution behavior was assumed. For the other plot, existing solubility limit data for oxygen in the liquid metal were used to determine a first-order term for departure from ideality. The use of the plots in evaluating the oxygen gettering capability of refractory metals in liquid metal cooling systems is illustrated by a simple example involving lithium, oxygen, and hafnium. Author

N72-31552*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT PRESS AND ROLL WELDING OF TITANIUM-6-PERCENT-ALUMINUM-4-PERCENT-VANADIUM BAR AND SHEET WITH AUTO-VACUUM CLEANING
Kenneth H. Holko Washington Sep. 1972 26 p refs
(NASA-TN-D-6958; E-6997) Avail: NTIS HC $3.00 CSCL 11F

Hot press butt welds were made in 0.5 in. diameter bar, and roll lap welds were made in 0.060 in. thick sheet of Ti-6A1-4V. For hot press welds made after auto-vacuum cleaning at 1800 F for 2 hours, weld strength and ductility equaled the parent metal properties. Only 5 minutes of pressing time were needed at 1800 F and 200 psi to make the hot press welds. Roll welds were made in sheet at 1750 F with only 10 percent deformation. The welds in the bar and sheet were metallurgically indistinguishable from the parent material. Author

N72-31553*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOCHEMISTRY OF TANTALUM-WALL COOLING SYSTEM WITH LITHIUM AND SODIUM WORKING FLUIDS
Leonard K. Tower Washington Sep. 1972 16 p refs
(NASA-TM-X-2640; E-7019) Avail: NTIS HC $3.00 CSCL 11F

Plots are presented which show the distribution of oxygen between liquid lithium and tantalum or niobium, and between liquid sodium and tantalum at elevated temperatures. Additional plots showing the composition of the gas phase above the solutions of oxygen and alkali metal are presented. The use of the plots is illustrated by an example tantalum heat pipe filled with lithium. Author

N72-31554# Lockheed-California Co., Burbank.
THE INFLUENCE OF SPECIMEN GEOMETRY ON CRACK TIP PLASTICITY
D. E. Pettit and D. W. Hoeppner Jun. 1972 32 p refs
(LR-25318) Avail: NTIS HC $3.75

The effect of panel width and thickness on the crack tip plasticity of center-cracked fracture panels of 7075-T6 aluminum alloy was examined. The plastic zone formation was continually monitored photographically during the fracture test and the zone size and shape determined by an image distortion technique. The influence of specimen width and thickness was examined to determine its effect on the plastic zone behavior and the mode (stable tear or pop-in) of initial crack extension. Plastic zone models were then compared with the characteristic plastic zone size parameters measured experimentally and the models evaluated. From these results, the effect of panel thickness and width on the fundamental characteristics of crack tip plasticity and initial crack extension was assessed. The importance and implications of these findings on methods of evaluating material toughness are examined. In addition, the applicability of these zone size models in linear elastic fracture mechanics applications are discussed. Author

N72-31555# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURE AND PHASE CHANGES IN FERRITIC STEEL DURING HEAT TREATMENT
K. V. Varli, E. N. Gorchakova, K. A. Lanskaya, A. M. Rivlin, and Yu. A. Skakov 21 Mar. 1972 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 13, no. 9, 1970 p 117-121
(AD-742812; FTD-HC-23-96-72) Avail: NTIS CSCL 11/6

On the basis of works conducted at the Central Scientific Research Institute of Ferrous Metallurgy it was established that forged steel EP-503 subjected to tempering for one hour at 725-750 C, possesses high heat resisting properties. Treating the steel according to this mode provides the necessary degree of solid solution decomposition and dispersity of intermetallic phase particles. The latter does not undergo substantial changes during further use. Author (GRA)

N72-31556# Alabama Univ., University.
DEVELOPMENT OF DISPERSION-HARDENED MAGNESIUM ALLOYS Final Report, 3 Nov. 1970 - 2 Jan. 1972
Edward J. Planz Jan. 1972 32 p refs
(Contract DAAH01-71-C-0258)
(AD-743248; BER-145-59) Avail: NTIS CSCL 11/6

The melting and casting of magnesium in which selective metallic oxides were mixed during the molten state for the production of dispersion-hardened magnesium alloys did not produce satisfactory results. Magnesium, because of insufficient wettability, rejected the stable oxides. Further evaluation of the melting and casting technique should be explored because of the economical and metallurgical advantages. Author (GRA)

N72-31557# Washington Univ., Seattle. Dept. of Mechanical Engineering.
A NUMERICAL AND EXPERIMENTAL INVESTIGATION OF THE USE OF J INTEGRALS
A. S. Kobayashi, S. T. Chiu, and R. Beeuwkes May 1972 31 p refs
(Contracts DA-31-124-ARO(D)-12; N00014-67-A-0103-0018; NR Proj. 064-478)
(AD-743204; TR-12) Avail: NTIS CSCL 11/6

Finite element analysis was used to determine numerically Rice's J-integral values in centrally notched plates of 4340 steel. These numerical values were compared with corresponding J-integral values using Dugdale model and antiplane strain model with a power law hardening of n = 0.3. J-integral was also computed for a crack extending into its own plastic yield region under constant loading. For increasing level of loading, sigma, the rate of increase in J-integral decreases and J-integral remains almost constant at (sigma/(sigma sub ys)) = 1 under such crack extension. A limited number of fracture tests were conducted with centrally notched 4340 steel specimens heat treated to yield strength levels of 150, 180, 210 and 240 ksi. Fracture data showed that the critical J-integral, calculated and measured, is insensitive to crack tip sharpness for the lower strength 4340 material and thus the (J sub c) fracture criteria appears suited in correlating fracture data. Author (GRA)

N72-31558# Army Foreign Science and Technology Center, Charlottesville, Va.
DEFORMABILITY OF NEODYMIUM AS A FUNCTION OF TEMPERATURE DEFORMATION RATE
V. A. Skudnov, L. D. Sokolov, and A. N. Gladkikh 13 Jan. 1972 8 p refs Transl. into ENGLISH from Akad. Navuk BSSR, Vestsi, Ser. Fiz.-Tekhn. Navuk (Minsk), no. 2, 1969 p 114-116
(AD-742893; FSTC-HT-23-503-71) Avail: NTIS CSCL 11/6

Test method for determining the deformation rate of a rare earth metal is described and results are given. Author (GRA)

N72-31559# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANICAL PROPERTIES AND STRUCTURE OF SOME TITANIUM ALLOYS AFTER THERMOMECHANICAL TREATMENT
I. M. Pavlov, A. Ye. Shlest, and Yu. F. Tarasevich 17 Feb. 1972 30 p refs Transl. into ENGLISH from the publ. "Plasticheskaya Deformatsiya Tugoplavkikh Metalloy i Spetsial'nykh Splavov" USSR, 1970 p 91-111
(AF Proj. 7351)
(AD-742685; FTD-HC-23-1997-71) Avail: NTIS CSCL 11/6

The study was done with the following Ti alloys of industrial origin, which represent all known type of Ti alloys: (1) single phase alpha Ti VT1, (2) 3 phase alloy of martensite type OT4, (3) 2 phase alloys VT6S and VT14 in which the high temperature phase can be partially fixed at room temperature, (4) single phase beta alloy VT15, and complex alloy ST1 intended for temperatures less than or equal to 700 degrees. Author (GRA)

N72-31560# California Univ., Los Angeles.
NEW TECHNIQUES FOR THE SYNTHESIS OF METALS AND ALLOYS, 1. THE PROPERTIES OF RARE EARTH METALS AND ALLOYS, 2 Semiannual Technical Report
R. F. Bunshah and D. L. Douglass Mar. 1972 67 p refs
(Contract DAHC15-70-G-0015; ARPA Order 1643)
(AD-742821; UCLA-ENG-7227; SATR-3) Avail: NTIS CSCL 11/6

The major areas of research are summarized and include the following: The high rate physical vapor deposition (HRPVD) process; The evaporation of a Ni-20Cr alloy from a single rod fed electron beam source; The effect of substrate temperature on the structure and properties of TiC prepared by activated reactive evaporation; The properties of rare earth metals and; alloys and; The oxidation behavior of Ni3Al and Ni3Al-0.5Y at 1200 C.
Author (GRA)

N72-31561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH ON THE DEFORMATION OF TENSILE TEST SPECIMENS OF CERTAIN TITANIUM ALLOYS AFTER THERMOMECHANICAL TREATMENT
I. M. Pavlov, A. E. Shelest, and Yu. F. Tarasevich 15 Feb. 1972 26 p refs Transl. into ENGLISH from "Plasticheskaya Deformatsiya Tugoplavkikh Metallov i Spetsial'nykh Splavov" Moscow, Izd. Nauka, 1970 p 111-125
(AF Proj. 7351)
(AD-742814; FTD-MT-24-1608-71) Avail: NTIS CSCL 11/6

An experimental dependence between the relative reduction and concentrated elongation is established on alloys VT1, OT4, VT6S and VT14. Analysis is made of the dependence of overall elongation and its individual components on the regime of thermomechanical treatment, and also the relation between the uniform elongation and the ultimate strength of the studied Ti alloys. A conclusion is made that the change of uniform elongation with drop in temperature of rolling or with an increase in the degree of deformation may give a qualitative presentation of work hardening. Author (GRA)

N72-31562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF PHASE EQUILIBRIA AND SOME PROPERTIES OF ALLOYS OF Ti-Al-Fe AND Ti-Al-V SYSTEMS
M. A. Volkova and I. I. Kornilov 13 Mar. 1972 13 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Metally (Moscow), no. 1, 1971 p 200-205
(AD-742693; FTD-HC-23-2092-71) Avail: NTIS CSCL 11/6

Some data on the structure and properties of Ti-Al-Fe alloys are presented. The phase equilibria in alloys in the system Ti-Al-V were studied. However, the data available in the literature on phase equilibria in the systems Ti-Al-Fe and Ti-Al-V require refinement, as they are insufficiently complete. The purpose of the present work is to compare the influence of iron and vanadium on the nature of the chemical interactions and on certain properties of alloys in the binary system Ti-Al.
Author (GRA)

N72-31563# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF SMALL CYCLE THERMAL AND MECHANICAL FATIGUE OF NICKEL-BASED ALLOYS
L. B. Getsov, A. F. Malygin, A. I. Fedosov, Yu. F. Balandin, and N. I. Kuptsova 14 Feb. 1972 13 p refs Transl. into ENGLISH from the publ. "Termoprochnost Makerialov i Konstruktivnykh Elementov" Kiev, 1969 p 162-169
(AF Proj. 668A)
(AD-742689; FTD-HC-23-2028-71) Avail: NTIS CSCL 11/6

Results are given of an investigation of small-cycle thermal and mechanical fatigue in tubular specimens of three nickel-based alloys under tensile stresses and temperatures approaching those experienced during actual operation. An analysis of the fatigue curves shows that the mechanical fatigue limit of these alloys is not below their thermal fatigue limit. Author (GRA)

N72-31564# Army Foreign Science and Technology Center, Charlottesville, Va.
DESTRUCTION OF MULTILAYER STEELS IN DYNAMIC AND STATIC LOADING
I. V. Navrotskii, Yu. S. Tomenko, and F. Ye. Dolzhenkov 24 Mar. 1972 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metal. (Moscow), no. 5, 1970 p 132-136
(AD-743034; FSTC-HT-23-11-72) Avail: NTIS CSCL 11/6

The relation of the number and distribution of the layers in laminated steels with viscous properties is investigated. It is found that the brittle failure resistance of laminated steel depends much more on the number of layers and their arrangement than on the total amount of viscous steel.
Author (GRA)

N72-31565# Watervliet Arsenal, N.Y. Benet Weapons Lab.
A GENERALIZED THEORY FOR CYCLIC PLASTICITY
William P. Dunn May 1972 40 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-743186; WVT-7208) Avail: NTIS CSCL 11/6

Non-linear constitutive relations for cyclic plastic deformation of metals are proposed along with criteria to determine the transition from elastic to plastic behavior. For a material initially homogeneous and isotropic, remaining homogeneous and isotropic during and after plastic deformation and whose elastic domain merely translates in stress-strain space, these relations require but one experimentally determined constant. For the three examples studied, analytic results are in good qualitative agreement with experimental results and in one example, quantitative agreement is good. Author (GRA)

N72-31566# General Motors Technical Center, Warren, Mich. Materials and Structures Lab.
DYNAMIC PROPERTIES OF S-200-E BERYLLIUM Final Report, 29 Apr. - 31 Aug. 1971
Douglas R. Christman and Frederick J. Feistmann Feb. 1972 61 p refs
(Contract DASA01-68-C-0114)
(AD-742522; MSL-71-23; DNA-2785F) Avail: NTIS CSCL 11/6

Results of an experimental study of the dynamic properties of S-200-E beryllium are presented. Areas studied included uniaxial stress behavior, elastic constants, equation of state, elastic precursor decay, and shock wave profiles. The material showed a yield plateau and then significant strain hardening, and exhibited strain rate sensitivity. Longitudinal and shear wave velocities at 20 C were 12.84 and 8.86 mm/microsec. The shock wave equation of state up to 30 kb was determined to be linear: sigma sub H = 0.7 + 152.7 u sub p. Compressive wave tests showed a ramped, non-steady-state elastic precursor, and shock wave profiles showing both release behavior and attenuation were obtained. Scanning microfractographs were taken of spall fracture surfaces. Author (GRA)

N72-31567# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
APPLICATION OF ELECTROCHEMICAL HYSTERESIS METHODS IN ASSESSING THE CORROSION BEHAVIOR OF ALLOYS
Ellis D. Verink, Jr. 1972 16 p refs
(Contract N00014-68-A-0173-0003)
(AD-742505) Avail: NTIS CSCL 11/6

Electrochemical hysteresis techniques may be used to construct experimental potential versus pH diagrams for alloy systems. Such diagrams are valuable alloy development tools since they provide a basis for comparison of the corrosion behavior of several alloys in a family of alloys. They also permit the presentation of relative corrosion rates for alloys as a function of potential and pH. The influence, if any, of systematic variations in electrolyte composition for example, variations in chloride concentration, may readily be assessed. The technique likewise may be used to investigate the influence of occluded cells such as crevices and pits. Author (GRA)

N72-31568# Florida Univ., Gainesville.
INFLUENCE OF PRIOR ELECTROCHEMICAL HISTORY ON THE PROPAGATION OF LOCALIZED CORROSION
E. D. Verink, Jr., T. S. Lee, III, and R. L. Cusumano 1972 7 p refs
(Contracts N00014-68-A-0003; N00014-68-A-0173-0015)
(AD-742500) Avail: NTIS CSCL 11/6

It has been shown that in chloride solutions, a binary FeCr alloy containing 16.9% Cr and 0.15% C, may be activated for pitting corrosion by subjecting it to potentials at and above the pitting potential (or rupture potential, E(R)). Once activated, pits will continue to propagate at potentials between E(R) and the protection potential E(P). It also has been shown for this alloy that unless the potential has been raised above the pitting (or rupture) potential, even intentional scratches do not propagate as active pits. Author (GRA)

N72-31569# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECT OF ULTRASONIC VIBRATIONS ON THE MECHANICAL PROPERTIES OF METALS UNDERGOING TORSION TESTING
V. P. Severdenko and E. I. Boiko 29 Oct. 1971 9 p Transl. into ENGLISH from Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Tekh. (Minsk), no. 4, 1961 p 82-85
(AD-742510; FSTC-HT-23-657-71) Avail: NTIS CSCL 11/6

Many component parts of modern structural elements are subject to the action of variable loads having various different frequencies and intensities. Many laboratories throughout the world now depend primarily upon the use of ultrasonic vibrations in the case of dynamic tests. The use of ultrasonic waves in materials testing offers new data on the properties of various materials, and also on the variation in those properties which arises under the effect of high-frequency loads. GRA

N72-31570# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL EXPANSION OF GROUP 4, 5, AND 6 REFRACTORY METAL SOLID SOLUTIONS
K. S. Pridantseva and N. A. Solovyeva 12 Mar. 1972 12 p refs Transl. into ENGLISH from the publ. "Materials Management" Kiev, Akad. Nauk Ukr. SSR., 1965 p 41-47
(AD-743391; FTD-HC-23-57-72) Avail: NTIS CSCL 11/6

As a result of investigating the thermal expansion of solid solutions for refractory metals of groups IV, V and VI of the periodic system, it was established that on the curves for relationship of thermal expansion coefficient to composition no minimums or maximums were observed which are inherent to alloys with ferromagnetic anomaly or to alloys in which the sigma-phase is formed. Author (GRA)

N72-31571# Naval Civil Engineering Lab., Port Hueneme, Calif.
CORROSION OF ALLOYS IN HYDROSPACE, 189 DAYS AT 5,900 FEET Final Report, Jun. 1968 - Jun. 1971
Fred M. Reinhart and James F. Jenkins Apr. 1972 41 p refs
(AD-743875; NCEL-TN-1224) Avail: NTIS CSCL 11/6

A total of 525 specimens of 60 different alloys were exposed at a depth of 5,900 feet in the Pacific Ocean for 189 days in order to determine the effects of the deep ocean environments on their corrosion resistance. Corrosion rates, types of corrosion, pit depths, and stress corrosion cracking resistance are presented. The materials evaluated were aluminum alloys 5086-H34, H32 and H112 and 6061-T6, and welded and unwelded 5083-H113 and 7039-T64; welded nickel alloys Ni-Cu 400 and K-500, Ni-Cr-Fe 600 and 718, Ni-Cr-Mo 625, and Ni-Fe-Cr 825; and wire ropes Ni-Cr-Mo 625, Ni-Co-Cr-Mo, Ni-Mo-Cr 'C' and Ni-Cr-Mo-103; three high strength-low alloy steels; six high strength steels; two austenitic cast irons; three stainless steels; two precipitation hardening stainless steels; and stainless steel and modified stainless steel wire ropes; and seven welded titanium alloys. Author (GRA)

N72-31572# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY INTO THE EFFECT OF IMPURITIES ON THE SURFACE TENSION OF IRON MELTS
L. I. Levi and S. A. Gladyshev 28 Mar. 1972 12 p refs Transl. into ENGLISH from Izv. Vyssh, Ucheb. Zaved., Chern. Met. (Moscow), no. 7, 1969 p 151-154
(AD-743245; FTD-HT-23-146-72) Avail: NTIS CSCL 11/6

The influence of Sn, Al, Cu, Ti, Sb, Bi, As, Pb, and Ce on the surface tension of pure Fe-C-Si melts of hypo- and hypereutectic point compositions were investigated. The experiments were carried out at 1500 degrees in He atmosphere Sn, Al, Cu, Bi, Sb, As, Pb, and Ce are surface active in the Fe-C-Si melts whereas Ti is inactive. The surface activity of

these elements is 1.5 times higher in the hypoeutectic point melts than in the hypereutectic point melts. Author (GRA)

N72-31573# Naval Civil Engineering Lab., Port Hueneme, Calif.
CORROSION OF MATERIALS IN SURFACE SEAWATER AFTER 12 AND 18 MONTHS OF EXPOSURE Final Report, Jun. 1966 - Jun. 1971
Fred M. Reinhart and James F. Jenkins Jan. 1972 106 p refs
(AD-743872; NCEL-TN-1213) Avail: NTIS CSCL 11/6

A total of 1150 specimens of 189 different alloys were completely immersed in surface seawater for 12 and 18 months to obtain data for comparison with deep ocean corrosion data. Corrosion rates, types of corrosion and pit depths were determined. Some highly alloyed nickel alloys, titanium alloys, silicon cast irons, specialty stainless steels, columbium, tantalum and tantalum-tungsten alloy were uncorroded in seawater both at the surface and at depth. Author (GRA)

N72-31574# Massachusetts Inst. of Tech., Cambridge. Casting and Solidification Section.
HIGH STRENGTH LIGHT ALLOY MATERIALS PREPARED FROM SPECIALLY CAST INGOTS Final Technical Report, 1 Nov. 1970 - 31 Oct. 1971
Robert Mehrabian, Dick Apelian, Thomas A. Caldwell, and Merton C. Flemings Apr. 1972 236 p refs
(Contract DAAG25-69-C-0489)
(AD-742656) Avail: NTIS CSCL 11/6

The studies are part of a continuing research activity on solidification and thermomechanical processing of aluminum ingots. The work is presented in three parts. (I) Experimental Verification of a New Heat Flow Analysis of Solidification; (II) Filtration of Aluminum Alloys; and (III) Die Castings of Partially Solidified Alloys. Author (GRA)

N72-31575# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
INVESTIGATION OF SOLIDIFICATION OF HIGH STRENGTH STEEL Interim Report, 1 Jan. - 31 Dec. 1970
D. S. Gnanamuthu, M. Basaran, T. Z. Kattamis, R. Mehrabian, and M. C. Flemings Jan. 1972 88 p refs
(Contract DAAG46-68-C-0043)
(AD-742657; AMMRC-CTR-72-6) Avail: NTIS CSCL 11/6

The effects of high temperature homogenization on sulfide inclusions were studied in unidirectionally solidified low alloy steel ingots containing Type II, Type III, and a mixed Type II-III sulfide inclusions. Specimens were taken at various distances from the chill and were heat-treated at 1315 C (2400 F) in vacuum and homogenized for various times between 20 and 100 hrs. Type II and mixed Type II-III sulfide inclusions coalesced to compact polyhedral shapes during homogenization. These more comapct shapes should be much less deleterious to mechanical properties than the original Type II and II-III inclusions. Microporosity was studied in unidirectionally solidified low alloy steel using X-ray microradiography and optical metallography. Author (GRA)

N72-31576# Pittsburgh Univ., Pa. Dept. of Chemistry.
MAGNETIC PROPERTIES OF LANTHANUM-NICKEL COMPOUNDS, Ln N15
W. E. Wallace 26 Feb. 1971 10 p refs Repr. from Monasthefte fuer Chem. (West Germany), v. 102, 1971 p 1455-1461 In GERMAN; ENGLISH summary
(Contract DA-ARO(D)-31-124-71-G74)
(AD-743632; AROD-5375) Avail: NTIS CSCL 11/6

Magnetic susceptibility-temperature measurements are presented for six LnNi5 compounds with Ln = Ce, Pr, Nd, Gd, Ho, and Tm, for the temperature range 2 to 300 K. Paramagnetic moments of the Gd, Ho, and Tm in the LnNi5 compounds are in good agreement with those expected for an assemblage of free tripositive ions. TmNi5 exhibits a tendency toward Van Vleck paramagnetism at low temperatures. Ferromagnetic ordering is exhibited by GdNi5, HoNi5 and TmNi5 at temperatures ranging from 22 to 23 K. The saturation moments of the Ho and Tm compounds are less than gJ presumable because of the crystal field interaction. Nickel appears to be magnetic to PrNi5 and NdNi5. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-31577# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHANGE OF TECHNICAL PROPERTIES OF BORIDE MATERIALS WITH COMPOSITION
H. Kotsch 3 Apr. 1972 20 p refs Transl. into ENGLISH from the publ. "International Power Metallurgy Conference, Karlovy Vary, CSSSR, vol. 4" 1970, p 315-332
(AF Proj. 7350)
(AD-743137; FTD-HC-23-1815-71) Avail: NTIS CSCL 11/2

Consideration is shown on properties such as creep strength, bending strength, impact strength, hardness and oxidation resistance of sintered materials of Cr-Ni-B, Cr-Mo-B and Cr-Tr-Mo-B systems in various concentration ranges. The results obtained are discussed in terms of equilibrium diagrams after Kolomytsev and his co-workers. Author (GRA)

N72-31578# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
WEATHERING PROPERTIES OF CROSSLINKED POLYETHYLENE Final Report
George R. Brown Mar. 1972 16 p refs
(AD-743295; DSPS-72-4) Avail: NTIS CSCL 11/9

Samples of crosslinked polyethylene were subjected to artificial weathering in an apparatus equipped with a sunshine carbon arc radiation source. Changes in tensile properties and water vapor transmission rates were observed. The material tested is used in a reuseable container being investigated for Air Force use. The container is presently being used by commercial airlines and conforms to the requirements set forth in specification ATA 300 of the Air Transport Association. Three colors (green, natural, and white) were tested. Author (GRA)

N72-31579# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE INFLUENCE OF THE NUMBER OF PORES AND THEIR DIMENSIONS ON THE THERMAL CONDUCTIVITY OF POROUS GRAPHITES
N. P. Kuznetsova, A. I. Lutkova, F. N. Mustafina, and V. Ya. Tsarev 10 Feb. 1972 18 p refs Transl. into ENGLISH from Khimiya Tverdogo Topliva, USSR, no. 3, 1970, p 107-114
(AD-742800; FTD-MT-24-1593-71) Avail: NTIS CSCL 11/2

Measurements were made of the effective thermal conductivity of various brands of porous graphites in the temperature range of 500-2600 K, and calculations were made of its components. A check is made of applicability of the formulas of a number of authors for the calculation of the effective thermal conductivity of porous graphites. Author (GRA)

N72-31580# Solar, San Diego, Calif.
EVALUATION OF COMPATIBLE TITANIUM ALLOYS IN BORON FILAMENT COMPOSITES Annual Summary Technical Report, 1 Dec. 1970 - 1 Dec. 1971
Gunther K. Schmitz, Mark J. Klein, Mike L. Reid, and Arthur G. Metcalfe Jan. 1972 100 p refs
(Contract F33615-71-C-1150; AF Proj. 7351)
(AD-743215; RDR-1722-1; AFML-TR-72-34) Avail: NTIS CSCL

11/4

Mechanical and physical properties of the two candidate titanium alloys, Ti 1310 and Ti 223 (Ti-13V-10Mo-5Zr-2.5Al and Ti-22V-3W-5Zr-2.5Al) were determined, and Ti 1310 was selected for further work. The alloy has good ductility, a room-temperature strength of 130,000 psi increasing to 160,000 psi after heat treatment, and high proportional limits desirable for boron composites. Elevated-temperature properties are adequate for composite usage. Short-length composite tape specimens were roll bonded and showed feasibility for fabrication of continuous Ti 1310/B tape with properties exceeding target data. Press bonding of high volume composite sheets were readily accomplished but strength was below target for reasons not yet determined at the time of writing. Scaleup from experimental buttons to a 30-pound ingot was successfully demonstrated by a commercial producer. Reports from the rolling mill indicate excellent ductility in cold rolling of foil.

Author (GRA)

N72-31581# Army Materials and Mechanics Research Center, Watertown, Mass.

DUPLEX CERAMIC STRUCTURES. KINETICS OF FABRICATION OF SILICON NITRIDE BY REACTION SINTERING Interim Report

Donald R. Messier and Philip Wong Mar. 1972 23 p refs

(DA Proj. 1T0-62105-A-330)

(AD-742669; AMMRC-TR-72-10; IR-1) Avail: NTIS CSCL 11/2

The reaction sintering process for the fabrication of silicon nitride, i.e., the reaction of silicon powder compacts with nitrogen, was investigated in the temperature range from 1150 to 1450 C, and the resulting silicon nitride was characterized by various analytical techniques. Oxygen impurities in the nitrogen atmosphere at high levels caused the formation of SiO2 and at low levels caused weight losses due to the formation of SiO gas. Fine particle size and iron impurities enhanced the reaction rate. The kinetics of the reaction of pure (99.99%) silicon powder compacts along with nitrogen follows the Jander relationship.

Author (GRA)

N72-31582# Brown Univ., Providence, R.I. Engineering Materials Research Lab.

EFFECT OF GAS DIFFUSION ON CREEP BEHAVIOR OF POLYCARBONATE

Hidemitsu Hojo and William N. Findley Apr. 1972 40 p refs

(Contract ARPA SD-86)

(AD-742826; EMRL-51; ARPA-E81) Avail: NTIS CSCL 11/9

Biaxial tension-tension creep experiments were performed to study the effect of gas diffusion on creep behavior of polycarbonate. Experiments were conducted on a thin-walled tubular specimen by applying both gas pressure and axial tension at room temperature, and measuring axial strain and gas absorption. It was found that the creep deformation was highly affected by the solubility controlled gas, carbon dioxide. The absorption measurements showed that the gas absorption behavior was clearly affected by the creep deformation of the material. Also an anomalous diffusion type behavior appeared even in permanent gas-polymer systems under creep conditions. The modified superposition principle satisfactorily predicted the recovery following creep. The axial creep for the biaxial tension-tension experiments were also computed from data previously reported for creep under combined tension and torsion of a different sample of polycarbonate. Author (GRA)

N72-31583# Army Foreign Science and Technoiogy Center, Charlottesville, Va.

ON THE INFLUENCE OF THE STRESS STATE ON THE CHARACTER OF RUPTURE OF TRANSPARENT POLYMERS BY A LASER BEAM

G. V. Pliatsko, Ya. S. Podstrigach, and V. M. Zhirovetskiy 17 Jan. 1972 10 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSR (Kiev), vol. 5, no. 4, 1969

(AD-742895; FSTC-HT-23-12-72) Avail: NTIS CSCL 11/9

Results are presented of theoretical analysis and experimental investigations of the effects of stretching and compressing forces applied to transparent polymers, the polymethylacrylate and polystyrene in particular, on the rupture of their material by a laser beam. Author (GRA)

N72-31584# Army Foreign Science and Technology Center, Charlottesville, Va.

SYNTHESIS OF REINFORCED MATERIALS ON AN ALUMINUM BASE

V. P. Severdenko, A. S. Matusevich, and A. F. Goncharov 29 Oct. 1971 9 p refs Transl. into ENGLISH from Akad. Navuk BSSR, Vestsi, Ser. Fiz.-Tekhn. Navuk (Minsk), no. 4, 1969 p 86-89

(AD-743036; FSTC-HT-23-672-71) Avail: NTIS CSCL 11/4

Increased interest shown in recent years regarding the technology of the production of reinforced materials has been promoted by the development of many methods of introducing high-strength fibers into a plastic matrix. This paper is devoted to a study of the dependence of the changes in the microhardness of fibers, the dimensions of the intermediate layers and their microhardness on the saturation temperature and holding time.

Author (GRA)

N72-31585# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.

A NUMERICAL SIMULATION OF THE CAVITY FILLING PROCESS WITH PVC IN INJECTION MOLDING

James L. Berger and Costas G. Gogos Feb. 1972 47 p refs

(Contract N00014-68-A-0131)

(AD-742745; TR-33) Avail: NTIS CSCL 07/1

A numerical simulation of the mold cavity filling process was attempted. The mold filled in this simulation is a disk which hot polymer melt enters through a tubular entrance located at the center of the top plate. The plate separation and outer radius of the disk cavity may be varied. A constant pressure applied at the entrance of the tube causes the flow. The cavity walls are kept at various low temperatures. The reported results are for rigid polyvinyl chloride (PVC). The general transport equations, i.e. continuity, momentum, and energy, for a constant density power law fluid are used to solve the flow problem. Using the results obtained it is possible to predict 'fill times'. The formation of a frozen polymer skin as the cavity fills may be followed via the velocity profiles. Author (GRA)

N72-31586# Avco Corp., Wilmington, Mass. Systems Div.

CONTINUOUS OXIDE FILAMENT SYNTHESIS (CVD)

Philip E. Gruber and Russell J. Hill Wright-Patterson AFB, Ohio AFML Jan. 1972 97 p refs

(Contract F33615-69-C-1501)

(AD-743228; AVSD-0029-72-CR; AFML-TR-71-251) Avail: NTIS CSCL 11/5

The program objective was to develop a process suitable for production of continuous aluminum oxide filaments at high rates by chemical vapor deposition. Several processes were investigated including gas phase hydrolysis or oxidation of AlCl3 and decomposition of organo-aluminum compounds; both high and low pressure deposition regimes as well as immersion in boiling liquid were investigated. Production of alpha-alumina filaments by chemical vapor deposition was achieved in some cases producing dense, small grained filaments; however, even the best appearing filaments had low strengths. Author (GRA)

N72-31587# Army Foreign Science and Technology Center, Charlottesville, Va.

ON THE QUESTION OF THE INFLUENCE OF LIQUID MEDIA ON THE LONGEVITY OF ORIENTED POLY-METHYLMETHACRYLATE

A. N. Tynnyi, N. A. Olkhovich-Novosadyuk, A. I. Soshko, N. G. Kalinin, and B. V. Perov 8 Oct. 1971 9 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr.

SSR (Kiev), no. 2, 1971
(AD-743042; FSTC-HT-23-90-72) Avail: NTIS CSCL 11/9

Experiments were carried out with oriented polymethylmethacrylate (PMMA) in water, heptane, and air to examine the influence of liquid media on the longevity of polymers. It was determined that orientation may prove a way to increase the durability of polymers in such reactions. Author (GRA)

N72-31588# Army Foreign Science and Technology Center, Charlottesville, Va.
PROPAGATION OF WAVES IN LAMINAR VISCO-ELASTIC MEDIUM
A. M. Shvidanenko 19 Apr. 1972 9 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5., no. 11, 1969 p 124-127
(AD-742642; FSTC-HT-23-318-72) Avail: NTIS CSCL 11/4

The dispersion equation which determines the wave number of a laminar medium is analyzed for elastic shear waves. The case when the material of one of the layers possesses visco-elastic properties is examined using the theory of elastic heredity. Author (GRA)

N72-31589# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
RELATIONSHIP BETWEEN DEFECT STRUCTURE AND ELECTRICAL PROPERTIES OF SELECTED OXIDES Final Report, Jul. 1960 - Sep. 1971
Norman M. Tallan Jan. 1972 14 p refs
(AF Proj. 7021)
(AD-743028; ARL-72-0013) Avail: NTIS CSCL 11/2

The investigation centered on the formation and interaction of point defects in potentially important ceramic materials, the role these defects play in determining the transport rates of charge and mass in these materials, and the transport mechanisms themselves. The specific properties studied were electrical conductivity, thermoelectric power and weight change for several of the transition metal oxides. Major accomplishments are summarized and publications generated under this effort are referenced. Author (GRA)

N72-31590# Naval Ordnance Lab., White Oak, Md.
AN EMPIRICAL CORRESPONDING STATES RELATIONSHIP FOR THE ELECTRICAL RESISTIVITY OF AMORPHOUS POLYMERS
R. W. Warfield 20 Apr. 1972 12 p refs
(AD-742769; NOLTR-72-54) Avail: NTIS CSCL 11/9

An empirical corresponding states relationship between reduced electrical resistivity T Tg and reduced temperature is set forth for a series of amorphous polymeric materials. This relationship makes possible the estimation of the resistivity of a polymer at any temperature from only a knowledge of its glass transition temperature. Also, it can serve as a test for the consistency of new data. Author (GRA)

N72-31591# Naval Ordnance Lab., White Oak, Md. Nonmetallic Materials Div.
ELASTIC CONSTANTS OF BULK POLYMERS
R. W. Warfield and F. Robert Barnet 12 Apr. 1972 14 p refs
(AD-742766; NOLTR-71-226) Avail: NTIS CSCL 11/9

Previously a static Multi-Modulus technique was described for the simultaneous determination of Young's and bulk moduli on a single specimen of a polymeric material. Additional data have now been accumulated. These fit the same pattern as the early data and further substantiate the validity of the multi-modulus technique for measuring the fundamental elastic properties of polymers. Author (GRA)

N72-31592# Naval Ordnance Lab., White Oak, Md.
CARBON FIBER STRUCTURE
J. V. Larsen and T. G. Smith 28 Oct. 1971 32 p refs
(WF51544201)
(AD-742765; NOLTR-71-166) Avail: NTIS CSCL 11/5

The structure of polyacrylonitrile (PAN) and cellulose (rayon)-based carbon fibers in cross-section was investigated using various microscopic techniques. Commercial PAN fibers were found to be circumferentially oriented on the outside and radially oriented on the inside. Thornel fibers(rayon)have oriented crystallites parallel to the fiber surface with the structure extending further towards the fiber center in higher modulus fibers. Author (GRA)

N72-31593# General Electric Co., Schenectady, N.Y.
INVESTIGATION OF CERAMICS FOR HIGH TEMPERATURE TURBINE VANES Final Report, 1 Apr. 1971 - 31 Mar. 1972
Svante Prochazka Mar. 1972 69 p refs
(Contract N00019-71-C-0290)
(AD-742857; SRD-72-035) Avail: NTIS CSCL 11/3

Hot-pressing of a 99.7% pure commercial silicon carbide powder with one percent boron addition has yielded a 99-% dense ceramic with 30 microns tabular grains and 50,000 psi flexural strength. A submicron particle size powder consolidated with 1% boron addition at 1950 C gives 108,000 psi strength at room temperature and 64,000 psi at 1500 C. Its microstructure is composed of 3.0 microns equiaxed SiC grains and less than 0.5% of free silicon forming isolated grains at the lower temperature and a grain boundary phase and intragranular inclusions at 2100 C. No boron containing phase could be detected. The structure is formed by a mixture of various hexagonal poly types with the alpha-6H form prevailing. Author (GRA)

N72-31594# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLANE TRICALORIMETRIC METHOD FOR MEASURING THERMAL CONDUCTIVITY OF POOR HEAT CONDUCTORS
Ya. M. Naziev 22 Mar. 1972 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Energ. (Minsk), v. 10, no. 7, 1967 p 76-81
(AD-743341; FTD-HC-23-148-72) Avail: NTIS CSCL 11/7

Equations were derived for the estimation of heat conductivity using the method of the flat tricalorimeter which permits the fast and simple determination of the heat conductivity of powder, fibrous and other insulation materials. The heat conductivity of the following material was determined: asbestos plates, wood turnings, celluloid, ebonite, leather-like rubber, leather, and thermoplastic materials. Author (GRA)

N72-31595# Naval Ordnance Lab., White Oak, Md.
IMMERSION APPARATUS FOR ULTRASONIC MEASUREMENTS
Bruce Hartmann and Jacek Jarzynski 14 Apr. 1972 35 p refs
(AD-742775; NOLTR-72-73) Avail: NTIS CSCL 11/9

An immersion apparatus for making ultrasonic measurements was constructed. This apparatus is used to measure longitudinal and shear sound speeds in polymeric materials as a function of temperature as well as sound absorption measurements. Seven polymers were evaluated and the measurements all compared favorably with available literature values. Using the immersion apparatus, sound speed measurements are accurate to plus or minus 2 percent while absorption measurements are accurate to plus or minus 10 percent. Author (GRA)

N72-31596# Marquette Univ., Milwaukee, Wis.
FUNDAMENTAL RESEARCH IN CERAMICS Final Report, 21 Jan. 1968 - 21 Jan. 1972
Walter M. Hirthe and M. A. Seitz Apr. 1972 86 p refs
(Contract F33615-68-C-1355; AF Proj. 7021)
(AD-744004; ARL-72-0048) Avail: NTIS CSCL 11/2

Electrical conductivity measurements on high purity polycrystalline specimens of TiO2 indicate that the influence of impurities on the defect structure is not as great as in less pure single crystals. Thermoluminescent data obtained on polycrystalline

ZnO are presented and interpreted in terms of a copper impurity-zinc vacancy defect complex. GRA

N72-31546 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF THE CONTACT PROPERTIES OF Ni-C AND Co-C FUSIONS WITH GRAPHITE
Yu. V. Naydich, V. M. Pervertaylo, and G. M. Nevodnik *In its* Met. of Alloys and High Temp. 17 Aug. 1972 p 39-45 refs (For availability see N72-31539 22-17)

N72-31970* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE ELASTIC PROPERTIES OF FIBER COMPOSITE LAMINATES WITH STATISTICALLY DISPERSED PLY ORIENTATIONS
E. Y. Robinson *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 48-60 refs (For availability see N72-31964 22-34)
CSCL 11P

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-31597# Energiya Publishing House, Moscow (USSR).
THE OPTIMUM NOMINAL METHOD AND ITS APPLICATION
G. V. Gorelova, V. V. Zdor, and D. V. Svecharnik 1970 200 p refs In RUSSIAN
Avail: NTIS HC $12.00

The theory and methods of calculating optimal settings or programs are considered for regulating and controlling apparatus with fixed probability characteristics for the apparatus itself and the processes controlling it. Various manufacturing processes are given as examples, and it is shown that to apply the recommended optimal nominal method, data on the economic effect on the use of the method must be considered. Algorithms and programs for calculating the complicated equations obtained by computer are given and examples of their solution are also presented.
Transl. by K.P.D.

N72-31598# Technische Hogeschool, Delft (Netherlands).
IDEAL SUBGROUPS OF ABELIAN GROUPS Ph.D. Thesis
Gottlieb Wilhelm Schroeder VanRooyen 21 Jun. 1972 60 p refs
Avail: NTIS HC $5.00

Within the development of the theory of Abelian groups, certain types of subgroups of any group G are defined in terms of the endomorphisms of the group G: Namely those subgroups H of a group G which are mapped into themselves by every endomorphism of the group G. Such subgroups are termed fully invariant subgroups. These types of subgroups of a group play a prominent role in the theory of groups; in particular they are useful in determining the structure of groups. Author

N72-31599# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
GHOST FREE DUAL MODEL WITH LEADING INTERCEPT MINUS ONE
J.-L. Gervais and A. Neveu Jun. 1972 23 p refs
(LPTHE-72/24) Avail: NTIS HC $3.25

A dual model is presented for which the leading intercept is -1, and where there are enough gauge conditions to remove all the ghosts when the dimension is less than or equal to the critical value 26. The model factorizes with the harmonic oscillator operators of the conventional model. Author

N72-31600# Technische Hochschule Munchen (West Germany).
ERROR PROPAGATION AND TRUNCATION ERRORS IN GENERALIZED MATRIX INVERSIONS Ph.D. Thesis [FEHLERFORTPFLANZUNG UND RUNDUNGSFEHLER BEI DER VERALLGEMEINERTEN INVERSION VON MATRIZEN]
Werner Sautter 1971 89 p refs In GERMAN
Avail: NTIS HC $6.50

Error analysis, post-error calculations, and iterative matrix refinement methods are used to evaluate error bounds in generalized matrix inversion and least square calculations. Rounding errors in approximative processes are studied by isolating numerical critical points for further elimination procedures through generalized matrix inversion. It is shown that iterative refinement is not necessary if a too large increase in matrix elements is avoided. Transl. by G.G.

N72-31601# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Applied Mathematics Research Lab.
A TABLE OF THE INVERSE SINE-AMPLITUDE FUNCTION IN THE COMPLEX DOMAIN Final Report
Henry E. Fettis and James C. Caslin Apr. 1972 182 p refs
(AF Proj. 7071)
(AD-743299; ARL-72-0050) Avail: NTIS CSCL 12/1

Let z equals sn(w,k) be the Jacobian sine-amplitude function as defined. The tables list five-D values of the quantity w equals u plus iv where z is given by z equals a plus ib, for some given values. The values of u and v are expressed as decimal portions of the quarter-periods K and K prime respectively. The modulus is given in the form k equals sin theta, with theta equal 5deg(5deg)85deg(1deg)89deg. Author

N72-31602# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ENERGY METHODS IN SELF-ADJOINT EIGENVALUE PROBLEMS. 2: RITZ-GALERKIN AND RELATED METHODS
Morris Morduchow and John G. Pulos Apr. 1972 68 p refs
(Contract N00014-67-A-0438-0006)
(AD-742818; PIBAL-72-13) Avail: NTIS CSCL 12/1

For linear self-adjoint systems with discrete eigenvalue spectra, the Galerkin, Rayleigh-Ritz and modified Rayleigh-Ritz methods are shown to yield upper bounds of the eigenvalues, and to converge, in all modes. Methods of obtaining lower bounds of the eigenvalues in all modes by means only of the above energy methods are established. The theory is illustrated by numerical examples, especially on vibrations of non-uniform beams. A simple general theorem and approximation is given for the effect of additional terms in the governing differential equations. These are then applied to vibrations of a beam on a nonuniform elastic foundation. Author (GRA)

N72-31603# Naval Ship Engineering Center, Philadelphia, Pa.
MODAL ANALYSIS OF A DISTRIBUTED PARAMETER SYSTEM FOR CONTROL AT AN UNSTABLE STEADY STATE Final Report
Alfred M. Loeb 22 May 1972 230 p refs
(SF Proj. 35-432-015)
(AD-743090; NAVSECPHILADIV-C-22) Avail: NTIS CSCL 12/1

The results are described of a detailed investigation of the dynamics of a distributed parameter system exhibiting three steady states, one of which is open loop unstable. The specific model selected for this study was the adiabatic tubular chemical reactor with axial flow mixing. The techniques developed for both analysis and simulation are directly applicable to a variety of problems in propulsion machinery systems control, particularly where the mathematical models involve distributed parameters. A form of modal analysis was employed to investigate the stability of the steady states and to devise a method for operating the reactor at the unstable state under feedback control. The results of this investigation, which were verified by a digital computer simulation of the nonlinear system, show that, for the conditions investigated, the unstable steady state may be

stabilized and that operation at the unstable state is possible. Furthermore, it is shown that the unstable state can be attained from reasonable start-up conditions. Author

N72-31604# California Univ., Berkeley. Operations Research Center.
THE MAIN RESULTS OF OPTIMAL CONTROL THEORY MADE SIMPLE
Stuart E. Dreyfus Apr. 1972 37 p refs
(Grant NSF GP-30961)
(PB-209574; ORC-72-9) Avail: NTIS HC $3.00 CSCL 12A

The results of optimal control theory are derived, for discrete-time problems, in simple ways which allow easy interpretation and extension. The aim is to make these results, and their continuous-time analogues, accessible and physically meaningful to economists and demographers. Author (GRA)

N72-31605# Army Foreign Science and Technology Center, Charlottesville, Va.
SOME CRITERIA FOR THE APPROXIMATION OF NONLINEAR CHARACTERISTICS (DETERMINISTIC INPUTS)
I. Kh. Rizkin 1972 16 p refs Transl. into ENGLISH from unidentified Russian article
(AD-743365; FSTC-HT-23-306-72) Avail: NTIS CSCL 12/1

The problem of the successful approximation of nonlinear characteristics still attracts research workers. At least two factors have heightened interest in it of late: the appearance of new types of semiconductor nonlinear elements (in particular, the tunnel diode) and the broadening use of electronic computers in the investigation of nonlinear problems. The possibility of using electronic computers permits reliance on relatively complicated approximating functions, so that the dilemma of approximation accuracy versus analytic simplicity involved in the difficulties of a problem and the above-cited success of an approximation appears less critical than when only manual methods were used in studying nonlinear problems.
Author (GRA)

N72-31606# Kentucky Univ., Lexington. Coll. of Engineering.
PROCEEDINGS 1972 SOUTHEASTERN SYMPOSIUM ON SYSTEMS THEORY
Apr. 1972 262 p refs Conf. held at Lexington, Ky., 3-4 Apr. 1972
(PB-208334; UKY-TR-45-72-EE3) Avail: NTIS HC $3.00 CSCL 12A

The document contains a collection of papers directed toward the interchange of ideas and dissemination of information among those concerned with the technical aspects of electronic and biological systems theory. Topics discussed include linear systems, network theory, advanced ground transportation systems, nonlinear and distributed parameter systems, switching and automata theory, optimal control theory, stochastic processes, computation methods and computer technology, biological systems, and systems applications. Author (GRA)

N72-31607# Wisconsin Univ., Madison. Mathematics Research Center.
THE SOLUTION OF MIXED BOUNDARY VALUE PROBLEMS USING INTEGRAL TRANSFORMATION FORMULAS
K. B. Ranger Apr. 1972 64 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-743636; MRC-TSR-1225) Avail: NTIS CSCL 12/1

Integral transformations are developed which map boundary value problems from one dimension to a higher or lower one. These transformations are applied to a new class of mixed boundary value problems for the needle (finite and semi-infinite) and also the asymmetric Stokes flow past a spherical cap.
Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-31608 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 20, NO. 3: DAILY ALTITUDE MAPS OF THE 10 mb AS WELL AS MONTHLY MEAN MAPS FOR 1961 (REVISED), PART 3 [METEOROLOGISCHE ABHANDLUNGEN. BAND 20, HEFT 3: TAEGLICH HOEHENKARTEN DER 10-mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1961 (NEUE BEARBEITUNG), TEIL 3]
Ingrid Buschner, Barbara Kriester, Karin Labitzke, and Richard Scherhag 1968 105 p refs In GERMAN
(QR-3-Pt-3) Avail: Issuing Activity

Daily stratospheric height and circulation charts of the Northern Hemisphere for the third quarter of 1961 are presented; included are also monthly median projections of atmospheric circulation. The charts show slow leveling of the summer high over the Northern Hemisphere with a steady shift of the Polar high southward into the European North Sea. Transl. by G.G.

N72-31609 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 128, NO. 3: RESULTS OF THE SYNOPTIC SERVICE DURING 1972. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, MARCH [METEOROLOGISCHE ABHANDLUNGEN. BAND 128, HEFT 3: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1972. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, MAERZ]
1972 200 p In GERMAN
Avail: Issuing Activity

Daily and monthly mean ground level and 500 mb upper atmospheric data are presented of the Northern Hemisphere for March, 1972. The charts include standard pressure levels, temperature and humidity levels, wind circulation, and other climatological observation data. Attached scientific studies cover the end phase of stratospheric temperature rise, evaluation of cloud cover density, and comparative studies on various vapor pressure formulas. Transl. by G.G.

N72-31610*# Texas A&M Univ., College Station. Dept. of Physics.
THEOREMS ON SYMMETRICS AND FLUX CONSERVATION IN RADIATIVE TRANSFER USING THE MATRIX OPERATOR THEORY
George W. Kattawar [1972] 16 p refs
(Contract NGR-44-001-117)
(NASA-CR-128115) Avail: NTIS HC $3.00 CSCL 04B

The matrix operator approach to radiative transfer is shown to be a very powerful technique in establishing symmetry relations for multiple scattering in inhomogeneous atmospheres. Symmetries are derived for the reflection and transmission operators using only the symmetry of the phase function. These results will mean large savings in computer time and storage for performing calculations for realistic planetary atmospheres using this method. The results have also been extended to establish a condition on the reflection matrix of a boundary in order to preserve reciprocity. Finally energy conservation is rigorously proven for conservative scattering in inhomogeneous atmospheres.
Author

N72-31611# Barringer Research Ltd., Rexdale (Ontario).
ATMOSPHERIC POLLUTION MONITORING
A. R. Barringer 1971 32 p refs Presented at Ann. ISA Conf.,

Chicago, Oct. 1971
Avail: NTIS HC $3.75

The characteristics of instruments designed to monitor and help control air pollution are discussed. Specifications include: (1) ruggedness, reliability, and minimum maintenance, (2) ability to operate in field locations and in hostile environments, (3) ability to reject interference due to other gases and the source spectrum and their variations, (4) sensitivities in parts per billion range for gases, if possible, and (5) low zero and span drift. The costs of such equipment are discussed. Author

N72-31612# Schweizerische Meteorologische Zentralanstalt, Zurich.
THE CLIMATE AS AN ELEMENT OF THE LAND MANAGEMENT PLAN
B. Primault 1971 30 p refs In ENGLISH, GERMAN, and FRENCH
(Rept-24) Avail: NTIS HC $3.50

The climatological data is intended to guide the regional management of a Swiss canton. The different elements of the climate are mentioned. The period of validity of the compiled data is also noted. Author

N72-31613# Japan Meteorological Agency, Tokyo.
BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY, NO. 53, JANUARY - DECEMBER 1969
Mar. 1972 45 p
Avail: NTIS HC $4.25

Atmospheric radioactivity was measured in Japan from January to December 1969, using a network of 20 ground stations. Radioactivity was observed in precipitation, airborne dust, sea water, mixture of precipitation and settled dust by gummed paper and pans, and free atmosphere by radiosondes. J.A.M.

N72-31614# Schweizerische Meteorologische Zentralanstalt, Zurich.
BOUNDARIES OF WEATHER REGIONS IN THE CENTRAL ALPINE AREA [ABGRENZUNG VON WETTERLAGEN IM ZENTRALEN ALPENRAUM]
Walter Kirchhofer 1971 70 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC $5.50

Small scale weather phenomena as related to synoptic scale circulation and pressure patterns over the Alps are investigated. The material is taken from the period 1955 to 1968. The sea level pressure pattern and the 500 mb-wind-field in the central part of the Alps are correlated with temperature, insolation and precipitation as observed at five typical locations in and around the Alps: Santis, Zurich, Geneva, Davos and Lugano. The investigation is carried out separately for each station, thus yielding specific synoptic criteria. Meteorological elements show considerable annual variation. Instead of subdividing the observational material into groups corresponding to seasons - a procedure which would have unduly reduced the number of available cases - the raw data are transformed. Climatological means of temperature, insolation, and precipitation are computed for each class of pressure and circulation patterns. Linear regressions between these quantities and synoptic parameters (viz. 500mb-surface and 1000/500mb-thickness) are given. These regressions are used as criteria for delimiting classes of synoptic situations. Author

N72-31615*# Allied Research Associates, Inc., Baltimore, Md. Geophysics and Aerospace Div.
FURTHER DEVELOPMENTS IN CLOUD STATISTICS FOR COMPUTER SIMULATIONS
David T. Chang and James H. Willand 5 Jul. 1972 204 p refs
(Contract NAS8-26847)
(NASA-CR-61389) Avail: NTIS HC $12.25 CSCL 04B

This study is a part of NASA's continued program to provide global statistics of cloud parameters for computer simulation. The primary emphasis was on the development of the data bank of the global statistical distributions of cloud types and cloud layers and their applications in the simulation of the vertical distributions of in-cloud parameters such as liquid water content. These statistics were compiled from actual surface observations as recorded in Standard WBAN forms. Data for a total of 19 stations were obtained and reduced. These stations were selected to be representative of the 19 primary cloud climatological regions defined in previous studies of cloud statistics. Using the data compiled in this study, a limited study was conducted of the homogeneity of cloud regions, the latitudinal dependence of cloud-type distributions, the dependence of these statistics on sample size, and other factors in the statistics which are of significance to the problem of simulation. The application of the statistics in cloud simulation was investigated. In particular, the inclusion of the new statistics in an expanded multi-step Monte Carlo simulation scheme is suggested and briefly outlined. Author

N72-31616*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATISTICAL SUMMARY AND TREND EVALUATION OF AIR QUALITY DATA FOR CLEVELAND, OHIO IN 1967 TO 1971: TOTAL SUSPENDED PARTICULATE, NITROGEN DIOXIDE, AND SULFUR DIOXIDE
Harold E. Neustadter, Steven M. Sidik, and John C. Burr, Jr. Washington Sep. 1972 23 p refs
(NASA-TN-D-6935; E-7006) Avail: NTIS HC $3.00 CSCL 04A

Air quality data for Cleveland, Ohio, for the period of 1967 to 1971 were collated and subjected to statistical analysis. The total suspended particulate component is lognormally distributed; while sulfur dioxide and nitrogen dioxide are reasonably approximated by lognormal distributions. Only sulfur dioxide, in some residential neighborhoods, meets Ohio air quality standards. Air quality has definitely improved in the industrial valley, while in the rest of the city, only sulfur dioxide has shown consistent improvement. A pollution index is introduced which displays directly the degree to which the environmental air conforms to mandated standards. Author

N72-31617*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC ELECTRICITY CRITERIA GUIDELINES FOR USE IN AEROSPACE VEHICLE DEVELOPMENT
Glenn E. Daniels Washington Sep. 1972 23 p refs
(NASA-TN-D-6901; M-194) Avail: NTIS HC $3.00 CSCL 04A

Lightning nas always been of concern for aerospace vehicle ground activities. The unexpected triggering of lightning discharges by the Apollo 12 space vehicle shortly after launch and the more recent repeated lightning strikes to the launch umbilical tower while the Apollo 15 space vehicle was being readied for launch have renewed interest in studies of atmospheric electricity as it relates to space vehicle missions. The material presented reflects some of the results of these studies with regard to updating the current criteria guidelines. Author

N72-31618# National Environmental Satellite Service, Washington, D.C.
CONVECTIVE CLOUDS AS TRACERS OF AIR MOTION
Lester F. Hubert and Andrew Timchalk Jul. 1972 15 p refs
(NOAA-TM-NESS-40) Avail: NTIS HC $3.00

Deviations between cumulus cloud motions (measured from sequences of satellite pictures) and wind (observed from ships during the Barbados oceanographic and meteorological experiment) were analyzed to determine the magnitude and the nature of the differences between these two sources of wind data and to deduce the mechanisms responsible for the deviations. It was found that a substantial part of the deviation was caused by short term changes of the reported (rawinsonde) winds. This suggests that low level cloud motions might correspond to synoptic scale air motion as closely as do balloon winds. Author

N72-31619# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
MASS SPECTROSCOPIC INVESTIGATIONS OF AIR POLLUTION: DETECTION METHOD FOR ORGANIC SUBSTANCES [MASSENSPEKTROMETRISCHE UNTERSUCHUNGEN VON LUFTVERUNREINIGUNGEN; HIER: NACHWEISMETHODE FUER ORGANISCHE SUBSTANZEN]
H. W. Dinges and K. Lenhardt Jan. 1971 45 p refs In GERMAN
(FTZ-A-513-TBr-3) Avail: NTIS HC $4.25

Mass spectroscopic analysis of organic air pollutants was carried out to investigate their effect on platinum and tungsten electric contacts. The separative power of adsorbents was also determined. Organic substances have concentrations in the ppm range, therefore detection must be done with microanalytic methods. An Aston mass spectrometer was used for air investigations. Since air pollutants occur in extreme mixture, ratios and the fragmentation in the mass spectrometer itself complicates the identification of single substances. A preseparation of the mixture was done in a column filled with polymer adsorbent. For comparison, the spectra of pure singular substances were recorded. The separative power of the adsorbent column was checked with known mixtures, and the resident time of the singular substances was recorded. ESRO

N72-31620# Istituto di Fisica Dell Atmosfera, Rome (Italy).
BIBLIOGRAPHY ON FOG (1950 - 1970) [BIBLIOGRAFIA 'NEBBIA' (1950 - 1970)]
M. Gazzi, G. Simonini, and V. Vicentini Jan. 1972 87 p refs In ITALIAN Prepared jointly with Aeron. Mil. Ital.
(IFA-STR-18) Avail: NTIS HC $6.50

A bibliography on fog from 1950 to 1969 is presented which includes analytical, experimental, and theoretical work relating to statistics, climatology, synoptic meteorology, microphysics, wind and humidity effects. ESRO

N72-31621# Istitute di Fisica Dell Atmosfera, Rome (Italy).
METEOROLOGICAL ASPECTS OF SNOW FORMATION IN THE ATMOSPHERE AND OF ITS METAMORPHISM [ASPETTI METEOROLOGICI NELLA FORMAZIONE DELLA NEVE NELL'ATMOSFERA E NEL SUO METAMORFISMO]
Franço M. Vivona Apr. 1972 22 p refs In ITALIAN Presented at the Italian Alpine Club Ann. Meeting on Osservatori della Neve e delle Valanghe, Passo del Tonale, 19-23 Nov. 1971
(IFA-RDP-46) Avail: NTIS HC $3.25

Various meteorological aspects of the processes of snow formation in the atmosphere and its successive metamorphism under different environmental conditions are reported. The effects of wind on the snow cover are also presented with reference to the avalanche phenomenon. The physical characteristics of the snow cover are given. ESRO

N72-31622# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Sep. 1972 [POLLUTION ATMOSPHERIQUE FUMEE ET SO2 BULLETIN MENSUEL, SEPTEMBRE 1971]
Sep. 1971 28 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations in September 1971 are tabulated. The air pollution measurement apparatus is briefly described. ESRO

N72-31623# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AND TOTAL OZONE MEASUREMENTS DURING THE SECOND HALF OF 1971 [ERGEBNISSE DER AEROLOGISISCHEN OZONSONDIERUNGEN UND DER GASAMTOZONMESSUNGEN IM 2. HALBJAHR 1971]
Mar. 1972 155 p In GERMAN
(Sonderbeob-18) Avail: NTIS HC $9.75

Results of aerological ozone soundings are presented in the form of tables and graphs. Ozone soundings were carried out once a week by means of balloon borne Brewer-Mast ozone sondes. The highest altitudes reached were the 17 mb level in 95%, the 10 mb level in 70%, and the 5 mb level in 11% of the cases. ESRO

N72-31624# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
DURATION AND AMOUNT OF PRECIPITATION ON THE HOHENPEISSENBERG [ANDAUER UND MENGE DER NIEDERSCHLAEGE AUF DEM HOHENPEISSENBERG]
Rudolf Aniol Apr. 1972 16 p refs In GERMAN
(Sonderbeob-19) Avail: NTIS HC $3.00

Tables are given of duration and amount of precipitation at Hohenpeissenberg, Germany, for the period 1960-1969. The data have been reduced and divided into: single precipitation, days of precipitation, and hours of precipitation. Additional data treated are: a comparison between rain gage and rain recorder, the duration of single showers divided into snow and rainfall, and the longest duration and highest amount of single showers. ESRO

N72-31625# Aeronautical Research Associates of Princeton, Inc., N.J.
THE APPLICATION OF INVARIANT MODELING TO THE CALCULATION OF ATMOSPHERIC TURBULENCE Final Report, 16 Nov. 1970 - 15 Oct. 1971
Coleman duP. Donaldson and Roger D. Sullivan Jan. 1972 69 p refs
(Contract F33615-71-C-1051; AF Proj. 682E)
(AD-740574; ARAP-171; AFFDL-TR-71-168) Avail: NTIS CSCL 04/1

A method for the calculation of turbulent shear flows by an invariant modeling closure of the equations for the second-order correlations of fluctuating quantities in a turbulent medium is described. The relationship of the primary computational scale used in this model and the longitudinal integral scale of the turbulence under consideration is determined. With these results in hand, a technique is described by which it should be possible to determine the intensity and integral scale of turbulence measured by instrumented aircraft when only partial spectra are available. Author (GRA)

N72-31626# Air Weather Service, Scott AFB, Ill.
AIR WEATHER SERVICE WEATHER-MODIFICATION PROGRAM (FY 1971) Annual Survey Report, No. 4
Herbert S. Appleman, Laurence D. Mendenhall, John C. Lease, and Robert I. Sax Apr. 1972 31 p refs
(AD-743288; AWS-TR-244; AR-4) Avail: NTIS CSCL 04/2

The annual report on the weather-modification activities of the Air Weather Service discusses the techniques, procedures, and results of the projects undertaken during FY 1971. Its primary purpose is to inform AWS field personnel on the weather-modification progress enjoyed during the year. Detailed reports of the individual projects are published elsewhere when warranted. COLD WAND, COLD FLAKE, COLD COWL, COLD CRYSTAL, WARM FOG, and COLD RAIN are the activities covered in this report. Author (GRA)

N72-31627# Naval Postgraduate School, Monterey, Calif.
NUMERICAL EXPERIMENTS WITH SEVERAL TIME DIFFERENCING SCHEMES WITH A BAROTROPIC PRIMITIVE EQUATION MODEL ON A SPHERICAL GRID M.S. Thesis
George Washington Heburn Mar. 1972 46 p refs
(AD-743083) Avail: NTIS CSCL 04/2

Four time differencing schemes were tested using a barotropic primitive equation model on a spherical staggered grid with an analytic input in order to compare amplitudes, phase speeds, and computation time for each. The methods tested were the

leapfrog, Euler-backward, leapfrog-trapezoidal, and Adams-Bashford. One set of experiments was performed using an averaging technique to reduce the effects of gravity waves in the higher latitudes. Another set was performed without the averaging in order to determine the effects of this technique on the solutions. Author (GRA)

N72-31628# *Naval Postgraduate School, Monterey, Calif.*
SPECIFICATION OF MARINE SURFACE BOUNDARY LAYER PARAMETERS M.S. Thesis
Donald Reed McConathy, Jr. Mar. 1972 104 p refs
(AD-743086) Avail: NTIS CSCL 04/2

Specification of parameters defining the mean, as well as the turbulent properties, of the over water surface layer is examined. A baroclinic boundary layer model is considered using Cardone's modifications for the marine environment. Data fields of pressure and temperature were selected as input, and original ship observations were utilized to verify the predicted surface parameters. The effects of stability changes, isobaric curvature, thermal wind, and the value of the von Karman constant in the model were examined with results shown. Author (GRA)

N72-31629# Naval Weather Service Command, Washington, D.C. 04/2
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS, JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 7: AREA 19: NIIGATA, AREA 20: AKITA, AREA 21: HAKODATE
May 1972 483 p refs
(AD-742797) Avail: NTIS

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas covered are Niigata, Akita, Hakodata, Japan. GRA

N72-31630# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
REGRESSION RELATIONSHIPS BETWEEN SATELLITE INFRARED RADIANCE AND TROPOSPHERIC TEMPERATURE M.S. Thesis
Bruce William Hepner Mar. 1972 50 p refs
(AD-742921) Avail: NTIS CSCL 04/2

Global temperatures are obtained using a linear least squares regression method with satellite radiation measurements, particularly those obtained from the SIRS-B aboard the NIMBUS 4 satellite. Regression equations relating temperature to spectral radiance observations are employed. The regression equations were then applied to independent observations to determine the feasibility of temperature determinations over sparse data regions. Author (GRA)

N72-31631# Army Foreign Science and Technology Center, Charlottesville, Va.
AUTOMATIC MULTIPLE POINT SYSTEM FOR MEASURING MICROPHYSICAL CHARACTERISTICS OF FOG IN EXPERIMENTAL INSTALLATIONS
Yu. I. Moiseenko and G. I. Shchelchkov 5 Nov. 1971 20 p refs Transl. into ENGLISH of the book "Avtomat. Mnogotochechnaya Sistema Dlya Izmereniya Mikrofiz. Kharateristikh Tumana v Eksperim. Ustanovkakh" USSR
(AD-743035; FSTC-HT-23-110-71) Avail: NTIS CSCL 04/2

The article is devoted to the automation of measuring the proportions of aerosol particles, their concentration and the character of distribution according to size, this in experimental installations of the Institute of Applied Physics. To determine the microphysical character of fogs created in these, two types of apparatus were used. The first type consists of an aerosol trap (lovushka) in which the cloud particles are caught, counting on inert settling, on a glass sheet with a special cover, after which these are photographed through a microscope, then calculated. The second type of apparatus concerns a photoelectric meter of aerosol particles. GRA

N72-31632# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODERN METHODS FOR THE ARTIFICIAL DISSIPATION OF FOG AND LOW CLOUDS AND EXPERIENCE IN USING THESE METHODS FOR AVIATION PURPOSES
I. I. Gaivoronskii, L. I. Drasnovskaya, and A. D. Solovev 28 May 1972 15 p refs Transl. into ENGLISH from the book "Tr. Konf. po Problemam Aviats. Meteorol," 1969 p 158-167
(AD-743026; FTD-HT-23-415-72) Avail: NTIS CSCL 04/2

The report contains review methods for the artificial dissipation of low-level clouds and fogs. A classification of dissipation methods is given. The classification was made on the basis of the physical processes capable of leading to an improvement of visibility in a fog. The classification makes it possible to analyze any modification methods by comparing them with the most characteristic methods listed in the table. It is proposed that the specific expenditures on energy (reagent) during a definite period be regarded as the principal criterion of method efficiency. Author (GRA)

N72-31633# Delaware Univ., Newark. Coll. of Marine Studies.
AN EXPERIMENTAL STUDY OF WIND VELOCITY PROFILES OVER A WAVY SURFACE Ph.D. Thesis
Francis J. Merceret Apr. 1972 125 p refs
(Contract N00014-69-A-0407; Grant NSF GA-16603)
(AD-742842; CMS-2MS065; TR-2) Avail: NTIS CSCL 08/3

Wind velocity profiles and turbulence measurements have been obtained over a plow corrugated field using hot-film and cup anemometers at sampling heights covering from 3 cm to 4 m. The profiles, based on averaging times from 5 to 15 minutes, fit the logarithmic model with correlation coefficients greater than 0.9 and with many greater than 0.97. The data support the conjecture of Ruggles (1970) that large and sporadic fluctuations in the roughness length and friction velocity observed over water are due to the generation of wind waves on the surface. Author (GRA)

N72-31634# Weather Wing (2nd), APO 332, New York.
EUROPEAN CLIMATOLOGICAL GUIDE Atlas
Willi Laun Jan. 1972 190 p refs
(AD-743148; WW2-Pamphlet-105-13) Avail: NTIS CSCL 04/2

The publication contains isoline charts showing monthly mean and extreme temperatures, mean number of thunderstorm days, precipitation amounts, frequencies of two categories of flying conditions, and other parameters, all for the European-Northern Africa-Mid East area. Author (GRA)

N72-31635# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICS OF CLOUDS AND THEIR MODIFICATIONS, SELECTED ARTICLES
8 Feb. 1972 136 p refs Transl. into ENGLISH from Tr. Fiz. Oblakov Aktiv. Vozdeistvii (Moscow), no. 17 99 p
(AD-742712; FTD-MT-24-1545-71) Avail: NTIS CSCL 04/2

Contents: The results of testing a hail-cloud model; A method of calculating vertical velocities with consideration of orography when forecasting small-scale precipitation; Study of the characteristics of propagation of an aerosol dispersed by the explosion of an El:Brus-2 anti-hail projectile in the atmosphere; Basic equations of the microphysics and thermohydrodynamics of a two-phase cloud medium; The question of the heterogeneous formation of the new phase; The equilibrium condensation of water vapor in an ascending air current; Thermodynamic conditions for the formation of a cumulus cloud; Development of the accumulation zone and its influence on an updraft. GRA

N72-31636# Electro-Mechanical Research, Inc., Sarasota, Fla. Telemetry Div.
WEATHER SATELLITE DATA HANDLING SYSTEM STUDY Final Report
William N. Waggener 22 Jun. 1972 241 p refs
(Contract N62306-72-C-0114)
(AD-744011; TR-5937-003; FAMOS-TR3-72) Avail: NTIS CSCL 04/2

The Weather Satellite Data Handling System is designed to process weather data received by the NASA Command and Data Acquisition stations at Gilmore Creek, Alaska, and Wallops Island, Virginia. Data from the TOS and ITOS series of satellites is received from the existing TOSCOM communications network at Offutt AFB, Nebraska, via a special X-136 wideband data terminal. The satellite signal at Offutt is recorded and/or transmitted over a second X-136 circuit to Monterey, California, where the data is processed at the Fleet Numerical Weather Center. The final report provides a study of the system configuration and operational capabilities; it also includes specifications of the overall system and each major item of hardware. Author (GRA)

N72-31151 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Chemistry and Physics.
ANALYTICAL PROBLEMS IN AIR POLLUTION CONTROL
A. P. Altshuller *In* NBS Anal. Chem.: Key to Progr. on Natl. Probl. Aug. 1972 p 245-293 refs (For availability see N72-31146 22-06)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-31637* Lockheed Missiles and Space Co., Sunnyvale, Calif.
SOLAR ENERGY POWERED HELIOTROPE Patent
Ralph Crawford, inventor (to NASA) Issued 25 Jul. 1972 6 p Filed 25 Sep. 1970 Supersedes N71-28460 (09 - 16, p 2628) Sponsored by NASA
(NASA-Case-GSC-10945-1; US-Patent-3,678,685; US-Patent-Appl-SN-75431; US-Patent-Class-60-23; US-Patent-Class-60-26) Avail: US Patent Office CSCL 17G

A solar energy powered heliotrope which functions in a passive, stored energy manner to orient a solar array toward the sun is discussed. A bimetallic motor element is activated by solar energy to generate a work output. A constant torque spring assembly coupled to the motor element stores useful energy as a function of the work output. A bimetallic sensing element detects misorientation between the solar array and the sun. An escapement mechanism is actuated by the sensing element whenever misorientation between the solar array and the sun is detected; the escapement mechanism automatically and incrementally releases the stored energy to rotate the solar array in discrete increments until it is oriented towards the sun.
Official Gazette of the U.S. Patent Office

N72-31638# Communications Research Centre, Ottawa (Ontario).
PREDICTION OF ATTITUDE MOTION OF ISIS SATELLITES
F. R. Vigneron, D. Harrison, F. Yip, and G. G. Bower Feb. 1972 41 p refs
(CRC-1226) Avail: NTIS HC $4.25

A mathematical model based on an averaging technique is developed for the prediction of attitude motion and spin rate of ISIS-A or ISIS-B under the action of the magnetic torquing control system. The derived motion equations are solved numerically on a digital computer. The model is verified by comparison with flight data of the ISIS-A for all modes of operation. In addition, two malfunctions of the control system are demonstrated. The program and the instruction for operation are given and the operational utility of the present model is illustrated. Author

N72-31639# Joint Publications Research Service, Arlington, Va.
AERONAUTIC NAVIGATION EQUIPMENT
26 Aug. 1970 80 p refs Transl. into ENGLISH from various issues of Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow)
(JPRS-51241) Avail: NTIS HC $6.00

The design, development, and performance of components of air navigation systems are examined. Subjects discussed are: (1) instrumental errors in gyroscopes, (2) error influence of accelerometer on measuring angular velocity, (3) magnetic moment of magnetized gyroscope, (4) drift of a gyroscope on a rotating base, and (5) inertial navigation system errors due to integration inaccuracy. For individual titles, see N72-31640 through N72-31651.

N72-31640 Joint Publications Research Service, Arlington, Va.
SOME INSTRUMENTAL ERRORS OF GYROSCOPES
M. A. Pavlovskiy *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 1-4 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 2, 1967 p 85-87 (For availability see N72-31639 22-21)

Estimates are made of specific examples of increases of axial and centrifugal moments of inertia of the frame of a Cardan suspension arising from static balance of the instrument, and also the centrifugal moment of inertia of the rotor arising from inaccurate dynamic balancing of it. Author

N72-31641 Joint Publications Research Service, Arlington, Va.
ON THE THEORY OF THE COMPENSATING GYROAZIMUTH
V. P. Demidenko, F. P. Lassal, and V. K. Zaremba *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 5-10 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 4, 1967 p 91-94 (For availability see N72-31639 22-21)

On the basis of precession theory, the equations of motion of a gyroazimuth of the compensating type are considered. A theoretically calculated value is obtained for possible accuracy in a specific example. Author

N72-31642 Joint Publications Research Service, Arlington, Va.
DYNAMIC BALANCING OF ROTORS **c09**
V. Ye. Myachin *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 11-17 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 4, 1967 p 100-104 (For availability see N72-31639 22-21)

A method for the combined determination and correction of unbalanced rotors is presented. The processes of locating and eliminating the unbalance, and the establishment of prerequisites for the effective automation of all processes of dynamic balancing are described. Author

N72-31643 Joint Publications Research Service, Arlington, Va.
ERROR INFLUENCE OF A REAL ACCELEROMETER ON THE MEASURING ACCURACY OF ANGULAR VELOCITY
V. I. Lopatin *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 18-23 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 4, 1967 p 87-90 (For availability see N72-31639 22-21)

Consideration is given to errors in the measurement of components of the angular velocity of a moving object with the aid of an existing accelerometer mounted on the rotor, when its sensitive axis is parallel to the rotation axis and the angular rotation velocity is not stable. Curves are presented for the dependence of measurement errors on the measured values of angular velocity. Author

N72-31644 Joint Publications Research Service, Arlington, Va.
CALCULATION OF THE AERODYNAMIC DRAG MOMENT FOR A GYROMOTOR OPERATING IN AIR
B. A. Delektorskiy and I. N. Orlov *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 24-30 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 6 p 91-96 (For availability see N72-31639 22-21)

Engineering calculations of aerodynamic drag moments of gyromotors operating in air are presented. Calculations are based on formulas obtained as a result of experimental investigations.
Author

N72-31645 Joint Publications Research Service, Arlington, Va.
THE EFFECT OF THE ELECTROMECHANICAL MOMENT OF A GYROMOTOR ON THE SYSTEMATIC DRIFT OF A TRIAXIAL GYROSTABILIZER
V. S. Slepkov *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 31-37 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 5, 1967 p 31-37 (For availability see N72-31639 22-21)

The operation of a triaxial gyrostabilizer in the presence of oscillations of the platform is considered. The equations of motion of the rotor of a two-degree gyroscope are formulated with consideration of electromechanical moments of the motor for the case of synchronous and asynchronous gyromotors. It is shown that the moment of the gyromotor leads to additional drift of the stabilized platform.
Author

N72-31646 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF MAGNETIC MOMENT OF MAGNETIZED GYROSCOPE
I. A. Ushakov *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 38-44 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 7, 1967 p 92-95 (For availability see N72-31639 22-21)

A formula for calculating the magnetic moment of a gyroscope is developed. The procedure depends upon the substitution of a cylindrical gyroscope of equivalent ellipsoid of rotation. Mathematical models are presented to support the theoretical considerations. It was determined that the value of the magnetic moment depends on the geometry and the rim material of the gyroscope, the skin depth, the structure of the external field, and the angle of incidence of the field with the gyroscope.
Author

N72-31647 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF THE PROBABILITY DISTRIBUTION FUNCTION OF RADIAL ERRORS IN A PLANE
D. N. Davydov *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 45-52 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 4, 1968 p 98-103 (For availability see N72-31639 22-21)

The problem of determining the probability of radial errors in a plane as obtained from measurements of the rectangular coordinates is examined. It is assumed that each of the initial errors of measurements has a normal law of distribution, with a zero of mathematical expectation. A formula for approximate calculation is given, and it leads to a curve of systematic error as a function of the ratio of the axes of equal probability ellipses.
Author

N72-31648 Joint Publications Research Service, Arlington, Va.
DRIFTS OF A GYROSCOPE ON A ROTATING BASE
V. P. Vedenin *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 53-60 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 8, 1968 p 67-72 (For availability see N72-31639 22-21)

An investigation is made of the equations for a three-degree astatic gyroscope. Results are obtained for determination of the drift of the gyroscope.
Author

N72-31649 Joint Publications Research Service, Arlington, Va.
ON THE APPLICATION OF SELF-ADJUSTING SYSTEMS IN DIRECTIONAL GYROSCOPES
V. P. Demidenko *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 61-66 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 1, 1969 p 84-87 (For availability see N72-31639 22-21)

The possibility of using a self-adapting system for increasing the accuracy of directional gyroscopes is examined. The use of the principle of self-adjustment to increase the accuracy of a directional gyroscope is based on the maintenance of the required quality of operation of the instrument under various conditions of use by means of precession of the gyroscope as a function of the amplitudes of forced oscillation. Mathematical models are included to support the theoretical considerations.
Author

N72-31650 Joint Publications Research Service, Arlington, Va.
CERTAIN ERRORS IN INERTIAL NAVIGATION SYSTEMS
E. I. Sliv, Ye. V. Safonova, and A. D. Ilicheva *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 114-118 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow) p 114-118 (For availability see N72-31639 22-21)

An investigation is made of the effect of inaccuracies in the compensation of accelerating forces of gravity on the accuracy of determining the coordinates of a moving object in systems of inertial navigation.
Author

N72-31651 Joint Publications Research Service, Arlington, Va.
INERTIAL NAVIGATION SYSTEM ERRORS DUE TO INTEGRATION INACCURACY
Ye. I. Sliv, Ye. V. Safonova, and A. D. Ilicheva *In its* Aeronautic Navigation Equipment 26 Aug. 1972 p 73-78 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 4, 1967 p 95-99 (For availability see N72-31639 22-21)

The performance of an inertial navigation system is analyzed. The analysis is based on the errors of the accelerometer and the integrator of the system.
Author

N72-31652# Committee on Post Office and Civil Service (U. S. Senate).
AIR TRAFFIC CONTROL CAREERS
Washington GPO 1972 99 p refs Hearing on H.R. 8083 before Comm. on Post Office and Civil Serv., 92d Congr., 2d Sess., 13 Mar. 1972
Avail: Comm. on Post Office and Civil Serv.

The development of a career program and greater flexibility in management of air traffic controller careers is discussed at this hearing.
G.G.

N72-31653# National Aviation Facilities Experimental Center, Atlantic City, N.J.
VISUAL APPROACH PATH INDICATOR (VAPI) EVALUATION Final Report, Jul. 1971 - Jul. 1972
Robert F. Gates and Thomas H. Paprocki Sep. 1972 16 p refs (FAA Proj. 071-312-12x)
(FAA-ARD-72-49; FAA-NA-72-64) Avail: NTIS HC $3.00

The Tri-color Visual Approach Path Indicator (VAPI), as modified for improved indentification, was evaluated for suitability as part of a two-segment visual approach slope indicator system, and for possible incorporation into the National Airspace System. The unit was tested, using the standard Simple Abbreviated Visual Approach Slope Indicator (SAVASI) system as a control for comparison, to determine effectiveness, environmental suitability and dependability of operation. The test results lead to the conclusion that, for a number of valid reasons, the VAPI unit was markedly inferior to the SAVASI system, and should not be considered either for use in the two-segment VASI, or for inclusion within the National Airspace System.
Author

N72-31654# National Aviation Facilities Experimental Center, Atlantic City, N.J.
VASIS SIGNAL TRANSITION ZONE AND COLOR MODIFICATIONS Interim Report, Jul. 1971 - Jul. 1972
Robert F. Gates and Thomas H. Paprocki Sep. 1972 25 p
(FAA Proj. 071-312-11X)
(FAA-ARD-72-91; FAA-NA-72-73) Avail: NTIS HC $3.25

The results of a portion of the overall project effort to develop an improved Visual Approach Slope Indicator System (VASIS) are presented. A method of decreasing the VASI signal pink transition zone was evaluated and the effect of substituting different color density and hue red filters was studied. As a result of the testing, it was concluded that the standard VASI signal can be significantly improved by a slight modification to the geometry of the transition bar and by substitution of different filters. Author

N72-31655# Academy of Sciences (USSR), Moscow.
ALGORITHMS OF THE CALCULATION OF NAVIGATIONAL INFORMATION CONCERNING THE POSITION OF SATELLITES
P. Ye. Elyarsberg, B. V. Kugayenko, and V. M. Sinitsyn 1972 29 p In RUSSIAN
Avail: NTIS HC $3.50

The coordinate systems and orbital elements used to calculate navigational information on satellite position are presented. Equations of motion, atmospheric density, and anomalies in the earth's gravitational field are characterized, as well as the gravitational effects of the moon and sun, light pressure, the calculation of star time, and sun and moon position. Transl. by K.P.D.

N72-31656# Joint Publications Research Service, Arlington, Va.
GYROSCOPIC AND NAVIGATIONAL INSTRUMENTS
30 Aug. 1972 20 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 6, 1972 p 79-92
(JPRS-56915) Avail: NTIS HC $3.00

Articles are presented on precision gyrovertical with inertial corrections, the stability of a single-axle gyrostabilizer with dry friction in the stabilizing and precession axes, and the application of dielectric films to the electrodes of an electrostatic gyroscope. For individual titles, see N72-31657 through N72-31659.

N72-31657 Joint Publications Research Service, Arlington, Va.
PRECISION GYROVERTICAL WITH INERTIAL CORRECTIONS
D. S. Pelpor *In its* Gyroscopic and Navigational Instr. 30 Aug. 1972 p 1-6 (For availability see N72-31656 22-21)

The theory of a precision gyrovertical with integral correction is discussed with varying orientation of the gyrovertical platform in azimuth and with introduction of damping. It is shown that such a gyrovertical has an error of around 1 angular minute. Author

N72-31658 Joint Publications Research Service, Arlington, Va.
ON THE STABILITY OF A SINGLE AXLE GYROSTABILIZER WITH DRY FRICTION IN THE STABILIZING AND PRECESSION AXES
N. Ya. Kogan *In its* Gyroscopic and Navigational Instr. 30 Aug. 1972 p 7-12 refs (For availability see N72-31656 22-21)

The method of point transformations of a plane to a plane, was used to prove the global stability of a set of equilibrium states of a single-axle gyrostabilizer for dry friction in the stabilizing and precession axes. Cases when the gyrostabilizer is stable and neutral, disregarding friction were considered. Author

N72-31659 Joint Publications Research Service, Arlington, Va.
CONCERNING THE PROBLEM OF APPLYING DIELECTRIC FILMS TO THE ELECTRODES OF AN ELECTROSTATIC GYROSCOPE
A. N. Balyasnikova and A. M. Korovkin *In its* Gyroscopic and Navigational Instr. 30 Aug. 1972 p 13-17 refs (For availability see N72-31656 22-21)

The influence of a dielectric film applied to the electrodes of an electrostatic gyroscope on the value of capacitance and ponderomotive force of an electrode rotor is considered. Formulas are developed for engineering calculations of the forces, taking into account the depth and quality of dielectric film, at rotor's displacement toward the electrode. Author

N72-31660*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TWO DIFFERENT APPROACHES FOR A CONTROL LAW OF SINGLE GIMBAL CONTROL MOMENT GYROS
Werner O. Schiehlen 2 Aug. 1972 28 p refs
(NASA-TM-X-64693) Avail: NTIS HC $3.50 CSCL 17G

In the field of momentum exchange attitude control systems, single gimbal control moment gyros (SGCMG) are of increasing interest. A gimbal angle approach and a gimbal rate approach are presented for the SGCMG control law including the singularity avoidance. Both approaches are compared and some illustrative examples are given. Author

N72-31661# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DRIFT OF A GYRO LINEAR ACCELERATION INTEGRATOR MOUNTED ON A VIBRATING BASE
I. N. Petrov 11 Apr. 1972 12 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), no. 121, 1970 p 42-50
(AF Proj. 7343)
(AD-743237; FTD-HC-23-143-72) Avail: NTIS CSCL 17/7

Analysis of the effect of the displacement of gyro unit center of gravity on the dynamic behavior of a gyro integrator mounted on a vibrating base is given. It is assumed that the vibration amplitudes of the base are small and that both the friction at the suspension axes and the effects of a stabilizer maintaining the gimbals in normal positions are negligible. Expressions for integrator drift are derived, showing that vibrations of the base at frequencies approaching those of the nutations of the base can lead to considerable reading errors in the integrator. Author (GRA)

N72-31455 Joint Publications Research Service, Arlington, Va.
INERTIAL GUIDANCE INFORMATION SYSTEMS
L. I. Tkachev *In its* Aeron. Instr. 27 Jul. 1972 p 50-76 refs (For availability see N72-31452 22-14)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-31662# Atomics International, Canoga Park, Calif.
SNAP REACTOR PROGRAMS Progress Report, Feb. Apr. 1972
15 Aug. 1972 113 p refs
(Contract AT(04-3)-701)
(AI-AEC-13032; M-3679-67-Ed) Avail: NTIS HC $7.75

The engineering effort was devoted to cladding material selection, fuel and cladding interaction tests, fuel bow analysis, and hydraulic analysis, as well as the initiation of the design of a reactor for application in a 5-kWe unmanned system. The selection of Hastelloy X as the reference cladding material for the current generation of ZrH reactors is reported. Author

N72-31663*# Atomics International, Canoga Park, Calif.
EXPERIMENTAL PHYSICS CHARACTERISTICS OF A HEAVY-METAL-REFLECTED FAST-SPECTRUM CRITICAL ASSEMBLY Summary Report
W. H. Heneveld, R. K. Paschall, T. H. Springer, V. A. Swanson, A. W. Thiele, and R. J. Tuttle 28 Jan. 1972 138 p refs
(Contract NAS3-14421)
(NASA-CR-120959; AI-72-33; SR-2) Avail: NTIS HC $9.00 CSCL 14B

A zero-power critical assembly was designed, constructed, and operated for the purpose of conducting a series of benchmark experiments dealing with the physics characteristics of a UN-fueled, Li-cooled, Mo-reflected, drum-controlled compact fast reactor for use with a space-power electric conversion system. The range of the previous experimental investigations has been expanded to include the reactivity effects of:(1) surrounding the reactor with 15.24 cm (6 in.) of polyethylene, (2) reducing the heights of a portion of the upper and lower axial reflectors by factors of 2 and 4, (3) adding 45 kg of W to the core uniformly in two steps, (4) adding 9.54 kg of Ta to the core uniformly, and (5) inserting 2.3 kg of polyethylene into the core proper and determining the effect of a Ta addition on the polyethylene worth. Author

N72-31664# Danish Atomic Energy Commission, Risoe. Research Establishment.
ELECTRONICS DEPARTMENT Semiannual Report, 1 Oct. 1970 - 31 Mar. 1971
Oct. 1971 28 p refs
(RISO-M-1430) Avail: AEC Depository Libraries

A review is given of the activities of the department in the fields of instrumentation for Risoe experiments, measuring methods, and automation. Topics treated in special chapters are as follows: aneroid barometer, EDP in future Risoe instrumentations, nuclear geophysical methods, EDP system for a power station, optimization of system models, verbal record from trouble-shooting jobs. Publications and lectures by staff members are listed. Author (NSA)

N72-31665# Massachusetts Inst. of Tech., Cambridge.
TWO PHASE VORTEX INVESTIGATION RELATED TO THE COLLOIDAL CORE NUCLEAR REACTOR Final Report, 15 Sep. 1970 - 9 Dec. 1971
W. S. Lewellen and D. B. Stickler Mar. 1972 48 p refs
(Contract F33615-71-C-1045; AF Proj. 7116)
(AD-744006; ARL-72-0037) Avail: NTIS CSCL 18/10

Liquid containment in a gas-driven vortex has been investigated both experimentally and theoretically. Average air-water mixture densities greater than 100 times the thru-flow gas density were contained in a vortex chamber while maintaining the loss rate of water at that due to vaporization. Interaction studies indicate a stronger coupling of the liquid to the gas than of the liquid to the wall. Results are discussed in terms of their applicability toward estimating the potential performance of a colloidal core nuclear reactor. Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-31666# Istituto Superiore di Sanita, Rome (Italy).
THE SEMINAR AT THE PHYSICS LABORATORY DURING THE PERIOD JULY - DECEMBER, 1970
10 Nov. 1971 24 p refs Partly in ENGLISH; mostly in ITALIAN Lectures presented in Rome
(ISS-71/31) Avail: NTIS HC $3.25

Summaries of lectures given at the Laboratory of Physics are reported. Topics of the lectures presented include: interactions of high energy protons, cellular membranes and chemical-physical phenomenon, protection of populations from ionizing radiation, and crystal structure. Transl. by F.O.S.

N72-31667*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
STUDY OF ACOUSTIC EMISSION DURING MECHANICAL TESTS OF LARGE FLIGHT WEIGHT TANK STRUCTURE Final Report, Sep. 1971 - Feb. 1972
Y. Nakamura, B. O. McCauley, and C. L. Veach 15 Mar. 1972 95 p refs
(Contract NAS9-12229)
(NASA-CR-115761; MSC-04800; FZK-390) Avail: NTIS HC $6.75 CSCL 20A

A polyphenylene oxide insulated, flight weight, subscale, aluminum tank was monitored for acoustic emissions during a proof test and during 100 cycles of environmental test simulating space flights. The use of a combination of frequency filtering and appropriate spatial filtering to reduce background noise was found to be sufficient to detect acoustic emission signals of relatively small intensity expected from subcritical crack growth in the structure. Several emission source locations were indentified, including the one where a flaw was detected by post-test X-ray inspections. For most source locations, however, post-test inspections did not detect flaws; this was partially attributed to the higher sensitivity of the acoustic emission technique than any other currently available NDT method for detecting flaws. Author

N72-31668# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
RADIATION OF MASSIVE GRAVITATION
P. VanNieuwenhuizen Jul. 1972 35 p refs Supported in part by a fellowship "Joliot Curie"
(LPTHE-72/26) Avail: NTIS HC $3.75

The radiation problem in massive and massless linear Einstein gravitation is analyzed for mass discontinuities in the limit of vanishing graviton mass m. It is found that in this limit the radiation into the massive helicity + or - 2 modes becomes equal to 3/4 of the total massless Einstein radiation, the radiation into the massive helicity + or - 1 modes tends to zero; and the radiation into the massive helicity 0 mode stays non zero and is model dependent. Two models illustrate this: (1) an oscillating point mass radiates for m tends to 0 into the helicity + or - 2 and 0 modes, and its total radiation limits to the massless Einstein radiation; (2) a pulsar radiates for m tends to 0, but only into the helicity 0 mode and Birkhoff's theorem is broken in linear massive gravitation. It is also broken in massive Maxwell theory, but holds in massless Maxwell theory. Author

N72-31669# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PHASE DIAGRAM OF A CHARGED BOSE GAS
J. P. Hansen, B. Jancovici, and Daniel Schiff Jul. 1972 13 p refs
(LPTHE-72/29) Avail: NTIS HC $3.00

The phase diagram of a charged Bose gas is presented, and the domains of existence of the solid, fluid, and superfluid phases are discussed. It is predicted that superdense helium can be superfluid at densities higher than 1,000,000 g/cc. Author

N72-31670# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
PROPERTIES OF EDGE FOCUSING BENDING MAGNET SYSTEM
F. W. Abdel-Salam 1971 19 p refs
(UARAEE-117) Avail: AEC Depository Libraries

Convenient matrix calculations for edge focusing bending magnets in the horizontal and vertical cases are presented. Equations for Q-pole lenses and for edge focusing bending magnets are given. The parameters of magnet systems such as object and image distances, focal lengths, and magnifications are given to calculate the resulting momentum dispersion and beam trajectories. Author (NSA)

N72-31671# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
STUDY OF THE PROPERTIES OF MAGNETIC FOCUSING SYSTEMS
F. W. Abdel-Salam 1971 30 p refs
(UARAEE-118) Avail: AEC Depository Libraries.

The characteristics of a system consisting of a bending magnet and quadrupole lenses in both horizontal and vertical cases, and in which the field index n is equal to one and also greater than one were investigated. The general case for a magnetic system using matrix calculations is given. The procedure for obtaining the parameters of a bending magnet, such as omega which is equal to the square root of (1-n(-)), and alpha which is the bending angle, is presented. Author (NSA)

N72-31672# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
RADIATION DETECTION IN THE FAR INFRARED BY THERMAL AND JOSEPHSON EFFECT DETECTORS [STRAHLUNGSEMPFANG IM FERNEN INFRAROT MIT THERMISCHEN DETEKTOREN UND JOSEPHSONDETEKTOREN]
J. Vobian Nov. 1971 171 p refs In GERMAN
(FTZ-A-14-TBR-5) Avail: NTIS HC $10.75

Golay detector cells, thermoelements, thermopiles, bolometers, pyroelectric (ferroelectric) detectors, and Josephson detectors, were investigated in relation to their capability to detect far infrared radiation or submillimeter waves in a telecommunication application. The Golay cell is sensitive at room temperature, but allergic to microphony and limited to small radiating power. Thermoelements and positive bolometers are simple and sturdy but their sensitivity and detectivity are low and the time constant relatively high. Negative bolometers are more sensitive, and by cooling down to 1 K detectivity can be improved. The Josephson detector was found to be a very promising receiver for the submillimeter range; it shows extremely small time constant and extremely high detectivity values. Unfortunately considerable difficulties are involved in manufacture and calibration. ESRO

N72-31673# SACLANT ASW Research Center, La Spezia (Italy).
GEOMETRICAL ACOUSTICS (RAY TRACING). PART 1: SESSIONS 1-3
15 Dec. 1971 211 p refs Proc. of conf. held at La Spezia, Italy, 27-30 Sep. 1971
(AD-742466; SACLANTCEN-Conf-PROC-5-Pt-1) Avail: NTIS CSCL 20/1

The document contains reports presented during the first three sessions of the Geometrical Acoustics (Ray Tracing) Conference held at SACLANTCEN on the 27-30 September 1971. The sessions on underwater sound transmission are titled the Medium, Ray Tracing Computation, and Comparison of Experiments with Ray Tracing Computations. GRA

N72-31674# SACLANT ASW Research Center, La Spezia (Italy).
GEOMETRICAL ACOUSTICS (RAY TRACING). PART 2: SESSIONS 4-6. INFORMAL PRESENTATIONS. CONCLUSION AND RECOMMENDATION OF THE CONFERENCE
15 Dec. 1971 181 p refs Proc. of conf. held at La Spezia, Italy, 27-30 Sep. 1971
(AD-742467; SACLANTCEN-Conf-Proc-5-Pt-2) Avail: NTIS CSCL 20/1

The document contains reports presented during the last three sessions of the Geometrical Acoustics (Ray Tracing) Conference held at SACLANTCEN on the 27-30 September 1971. The sessions on underwater sound transmission are titled Extensions of Ray Tracing to Caustics, Convergence and Shadow Zones; Theory, Statistical Aspects and Range Dependent Ray Tracing; and Applications of Ray Tracing. Also included are informal presentations, conclusions, and recommendations of the conference. GRA

N72-31675# General Electric Co., Philadelphia, Pa. Space Div.
SECEDE 2 FOREOPTICS AND RECORDING EQUIPMENT SUPPORT: OPTICAL INTERFEROMETER Interim Technical Report, 1 May 1970 - 3 Mar. 1971
Raymond H. Lambert Jan. 1972 137 p
(Contract F30602-71-C-0046; ARPA Order 1057)
(AD-743289; RADC-TR-72-76) Avail: NTIS CSCL 17/8

A ground based optical system is described in detail. The system consists of a manual sighting station, main pedestal, television subsystem, control console, video console, timing system and digital data handling system. Its primary function is to point a Fabry-Perot Interferometer to programable points in the far field and record all position, time, house-keeping and optical information. Author (GRA)

N72-31676# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON EMISSION FROM CATHODE IN INITIAL PHASE OF NANOSECOND VACUUM DISCHARGE
G. A. Mesyats, G. P. Bazhenov, S. P. Bugaev, D. I. Proskurovskii, V. P. Rotshtein, and Ya. Ya. Yurike 31 Mar. 1972 8 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk, USSR), v. 84, no. 5, 1969 p 153-154
(AD-743246; FTD-HT-23-319-72) Avail: NTIS CSCL 20/3

A study was made of electron emission from a pointed molybdenum cathode and a flat cathode, using voltage-pulse generators for the attainment of an electron current amplitude of 5 kA. Associated vacuum chamber was pumped to a given pressure. Determinations were made of delay time in the appearance of electron current and the specific mass of metal transported from the pointed electrode. Emission from the point electrode was found not to be autoelectronic in nature. Author (GRA)

N72-31677# Woods Hole Oceanographic Institution, Mass.
USE OF A COHERENT FREQUENCY SYNTHESIZER IN ECHO-SOUNDER STUDIES OF DEEP SCATTERING LAYERS
Paul T. McElroy May 1972 14 p refs
(Contract N00014-70-C-0205)
(AD-742824; WHOI-72-30) Avail: NTIS CSCL 17/1

A coherent frequency synthesizer under computer control is used to generate a pulse train which is power amplified and drives a UQN transducer. A pulse train at the two frequencies, 9.5 and 17 kHz, is used to examine the deep scattering layers at 35 degrees 00 min N, 48 degrees 00 min W during the sunset migration. Striking differences in the scattering returns, as displayed on a facsimile recorder, show the utility of this method for increased frequency coverage in studies of deep scattering layers. Author (GRA)

N72-31678# Illinois Inst. of Tech., Chicago. Dept. of Physics.
GENERATION OF ULTRA-HIGH MAGNETIC FIELDS Final Report, 1 Oct. 1964 - 26 Oct. 1971
T. Erber 1972 10 p refs
(Contract DA-ARO(D)-31-124-G611)
(AD-742741; AROD-5336-25-P) Avail: NTIS CSCL 20/3

The overall objective of the research was to set up facilities to generate transient magnetic fields in the megagauss range. The principal application envisaged was the eventual combination of megagauss targets with high energy accelerator beams to test fundamental features of quantum electrodynamics. Both of these objectives were met within the duration of the grant. This report summarizes the principal results of the research.
Author (GRA)

N72-31679# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AVERAGED SOUND TRANSMISSION IN RANGE DEPENDENT CHANNELS Final Report
Preston W. Smith, Jr. 28 Jan. 1972 69 p refs
(Contract N00014-69-C-0022)
(AD-742490; BBN-2320) Avail: NTIS CSCL 20/1

An integral formula is derived as an estimate of the averaged, steady-state transmission ratio for two points in a channel where the environmental parameters vary slowly with range. The derivation is based on the theory of ray acoustics with lossy specular reflection from the boundaries. The averaging eliminates all but gradual changes with range of the transmission loss TL dependence on the depth of each point is retained. The formulation is applied to an isogradient channel with constant bottom slope. Analytical approximations for TL are derived.
Author (GRA)

N72-31680# Air Force Academy, Colo. Frank J. Seiler Research Lab.
BASE MOTION ISOLATION OF A TWO AXIS BEAM DEFLECTOR
Gary C. Comfort May 1972 21 p refs
(AF Proj. 7904)
(AD-743002; SRL-TR-72-0008) Avail: NTIS CSCL 17/8

The base motion isolation characteristics of an optical deflector with a two-axis gimbal support are investigated. The particular configuration of the beam deflector system considered utilizes rate integrating gyros to provide a rate inner control loop with an optical tracker providing an outer position control loop. Base motion isolation is partially achieved by the gimbal support assumed to be frictionless. However, input beam motion relative to the optical surface of the beam deflector is shown to produce large excursions of the output beam. As a result, a feed-forward control loop is added to measure and compensate for input beam motion, i.e., base motion.
Author (GRA)

N72-31681# Naval Postgraduate School, Monterey, Calif.
STATISTICAL RELATIONS BETWEEN SALINITY, TEMPERATURE AND SPEED OF SOUND IN THE UPPER OCEAN M.S. Thesis
Harry Augustus Seymour, Jr. Mar. 1972 108 p refs
(AD-742943) Avail: NTIS CSCL 08/10

In situ measurements of salinity and temperature fluctuations at depths to 14 meters indicate distinct dependences at different times of the day. The variance of the salinity fluctuations decreased with increasing depth, but was greater just after sunrise than just prior to sunset. The variance of the temperature fluctuations decreased with increasing depth just prior to sunset, but increased with depth immediately after sunrise. The correlation length of the sound index of refraction was calculated by using the variance of the sound velocity fluctuations, and the variance of sound amplitude modulation in the theory of Mintzer. This analysis shows that microstructure patch size increases approximately linearly with depth. The power spectral densities of the salinity, temperature and sound velocity fluctuations show peaks of energy corresponding to dominant ocean wave frequencies.
Author (GRA)

N72-31682# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
SPEED OF SOUND IN SEVERAL LIQUIDS Interim Report
Robert W. Timme 9 Jun. 1972 14 p refs
(SF Proj. 11-121-303-14083)
(AD-743885; NRL-MR-2443) Avail: NTIS CSCL 20/11

The speed of sound in several liquids has been measured as a function of temperature between 0 and 40 C. Data are given for DB castor oil, FC-45 (a fluorinated hydrocarbon), DC 200/.65 (a silicone fluid), Robane, Robalene, Robuoy (organic hydrocarbon fluids), octyl and acetate, and Coolanol-35 (a Freon-type fluid). The compatibility of these liquids with the more commonly used transducer elastomers has been measured.
Author (GRA)

N72-31683# Naval Underwater Systems Center, Newport, R.I.
THE FAST FIELD PROGRAM (FFP) AND ATTENUATION LOSS IN HUDSON BAY
Frederick R. DiNapoli and Mary Rita Powers 19 Apr. 1972 43 p refs
(AD-743065; NUSC-TR-4253) Avail: NTIS CSCL 20/1

The Fast Field Program (FFP) was developed to provide rapid, accurate, propagation-loss predictions for a generalized environmental model. This report demonstrates the utility of the FFP, in a different capacity, as a research tool to investigate the sound attenuation in a water column. Hudson Bay was selected as the area of application because the results of propagation experiments conducted there during August 1970 were available and interesting. The experimentally determined values of the attenuation coefficient for the frequency band 315 to 1600 Hz were found to exceed the values that would be predicted from existing formulas based on empirical relationships. The possibility that this anomalous behavior could have been due to energy leakage into the bottom is examined, and the values of the attenuation coefficient determined from the FFP analysis are compared with experimental results.
Author (GRA)

N72-31684# Naval Research Lab., Washington, D.C. Laser Physics Branch.
ULTRAVIOLET OUTPUT FROM PULSED SHORT ARCS Final Report
John B. Trenholme and John L. Emmett Apr. 1972 32 p refs
(AD-743057; NRL-MR-2427) Avail: NTIS CSCL 13/1

A pulsed ultraviolet source consisting of microsecond, kiloampere discharges across a millimeter gap in the noble gases was investigated. The optical output was monitored in the 1800 - 3000 A region. It was found that maximum time-integrated output was achieved with xenon, but that duration as well as amplitude increased in the He-Xe sequence. The output saturated with pressure at about 5 atm in all the gases. A 200 nsec current pulse was almost three times as efficient as a 700 nsec pulse, because the UV output is associated with high current density in a narrow initial arc channel, and the longer pulse allows more time for radial expansion. The UV reduction and amplitude jitter reduction due to a dc keep-alive current were also investigated.
Author (GRA)

N72-31685# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A SEARCH FOR APOCHROMATIC LENS SYSTEMS
Richard R. Fisher 3 Apr. 1972 19 p refs
(AF Proj. 7649)
(AD-744073; AFCRL-72-0227; AFCRL-IP-175) Avail: NTIS CSCL 20/6

One hundred and sixteen separate crown glass types were examined in pairs with numerical models so that apochromatic corrections could be evaluated. In this study all lenses were corrected for the C and F lines, leaving the third wavelength as a parameter of the search for good color correction. A number of glass pairs yielding good apochromatic corrections over the C, F, and lambda wavelength range are tabulated. By the addition of a third type of crown glass to one of the discovered aprochromatic doublets, satisfactory color correction may be obtained over an even wider wavelength range. This method of the extension of an apochromatic pair of lenses into an apochromatic triplet system is accomplished with a very low power third element, and this low power element may be used to correct spherical

aberration. One such triplet is evaluated in some detail.
Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-31686# Tokyo Univ. of Education (Japan). Dept. of Physics.
SINGLE PARTICLE DISTRIBUTIONS IN THE SMALL x REGION
Sunao Sakai [1972] 24 p refs
(TUEP-72-22) Avail: NTIS HC $3.25

The multiperipheral model for x = 0 is extended to the region where x is not zero but is small (within approximately + or - 0.2). The results show that the model is successful in fitting the data in this region without absolute normalization. The model fits the data on both transversal and longitudinal momentum distributions. Author

N72-31687# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ON THE ASYMPTOTIC BEHAVIOUR OF DUAL AMPLITUDES WITH MANDELSTAM ANALYTICITY
L. Gonzalez and Hong Tuan Jun. 1972 13 p refs
(LPTHE-72/20) Avail: NTIS HC $3.00

Some points about the asymptotic behavior of M(s,t) for the absolute value of s approaching infinity in any direction in the physical sheet are discussed. Principal results show that in order to have Regge behavior and fixed t dispersion relations, alpha (s) must grow asymptotically as c(square root of s)(ln s). Author

N72-31688# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
FEYNMAN RULES FOR MASSIVE GAUGE FIELDS WITH DUAL DIAGRAM TOPOLOGY
J. L. Gervais and A. Neveu Mar. 1972 36 p refs
(LPTHE-72/13) Avail: NTIS HC $4.00

The relationship of dual models with renormalizable theories of massive Yang-Mills field is studied by the zero slope limit. The field theoretics meaning of the twisting operator and the topology of dual models is clarified. These features result from the choice of a special nonhermitian gauge condition in the underlying field theory. The local gauge invariance of that theory is the exact reflexion of the first set of gauge identities appearing in the dual theory. In the nonhermitian gauge, some renormalizable massive vector meson theories are both manifestly unitary and manifestly renormalizable, and this leads to a spectacular simplification of the Feynman rules. Author

N72-31689# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
FULLY SYMMETRIC EXTENSION OF THE DUAL PION MODEL
R. Aldrovandi and A. Neveu May 1972 11 p refs
(LPTHE-72/19) Avail: NTIS HC $3.00

The fully symmetric dual model (Shapiro-Virasoro model) is extended by introducing anticommuting operators similar to those of the dual pion model. In this new fully symmetric model, there is no tachyon on the leading trajectory, which begins with a massless spin two particle. Such a model might prove useful for Lagrangian theories of spin two gauge fields like gravitation.
Author

N72-31690# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
KAON (PLUS) PHOTOPRODUCTION AND THE F/D RATIO FOR VECTOR AND TENSOR MESON COUPLINGS TO BARYONS
J. L. Alonso, D. Schiff, and J. TranThanhVan [1972] 12 p refs
(LPTHE-72/15) Avail: NTIS HC $3.00

Positive kaon photoproduction data in photon proton yields positive kaon(lambda, sigma) reaction are described by a conventional absorptive cut model applied to kaon (resonance) - kaon (resonance,resonance) absorbed exchanges. A good quantitative agreement is obtained when the kaon contribution is included, which turns out to be substantial in the forward direction for photon proton yields positive kaon lambda hyperon. The F/D ratio for vector and tensor meson couplings to baryons is discussed and predictions for the up-down asymmetry from a polarized nucleon, P, and for the asymmetry with polarized photons A are presented. The sign of P is fixed with SU(3) and the vector dominance model hypothesis. Author

N72-31691# Maryland Univ., College Park. Center for Theoretical Physics.
MELLIN-TRANSFORM ANALYSIS OF LIGHT-CONE STRUCTURE AND SCALING IN INELASTIC ELECTRON SCATTERING
D. Bhaumik, O. W. Greenberg, and R. N. Mohapatra Jul. 1972 34 p refs
(Grant NSF GP-8748)
(TR-73-006) Avail: NTIS HC $3.75

Experiments on high energy e-p scattering confirmed scaling of the inelastic structure functions. Scaling behavior of structure functions is related to the singularity structure of the proton matrix element of the electromagnetic current commutator near the light cone. By using the technique of the Mellin transformation, the scaling behavior and light-cone dominance of the structure function was studied. The constraints on the weight function which lead to scaling in the Bj limit are given and the relation of light-cone singularities and dominant behavior in the Bj domain is shown. Author

N72-31692# Nihon Univ., Tokyo (Japan). Dept. of Physics.
UR-CITON; A UNIFIED SCHEME OF HADRONS, AND ITS APPLICATION TO WEAK INTERACTIONS AND ELECTROMAGNETIC FORM FACTORS
Shin Ishida, Kimiaki Konno, Katsuya Nakamura, Masuho Oda (Waseda Univ.), and Yasuhito Yamazaki [1972] 45 p refs
(NUP-A-72-11) Avail: NTIS HC $4.25

A theoretical scheme for unified treatment of all hadrons is presented, which includes the quark model without the difficulties regarding spin statistics connection and binding problem. Our essential idea exists in the following: the inner Fock expansion of the general inner state vector is considered. Then the expansion coefficients, which satisfy the generalized Bargmann-Wigner equations, are considered to represent the hadron fields, and are second-quantized, following the prescription of the usual quantum field theory. The same level scheme of mesons and baryons is reproduced, as in the usual quark model. A general scheme for getting various kinds of effective vertices among hadrons is investigated also. It is useful to use a diagram, called the ur-citon diagram, which is written with lines with an arrow representing a flow of ur-citons. A tentative application to the electromagnetic form factors of nucleons is shown to lead to a satisfactory result which reproduces the experimental behavior, the scaling law, and the dipole-like behavior. Author

N72-31693# Nihon Univ., Tokyo (Japan). Dept. of Physics.
NEW UNIVERSALITY OF WEAK INTERACTIONS AND UR-CITON SCHEME
Shin Ishida and Masuho Oda (Waseda Univ.) [1972] 13 p refs
(NUP-A-72-9) Avail: NTIS HC $3.00

A form of universality for weak interactions is proposed based on the ur-citon scheme. It is used to derive an effective

Hamiltonian for arbitrary weak processes without parameters except a universal coupling strength, the Cabibbo angle, and a constant inherent to the ur-citon scheme. The universality is shown to be valid in application to the decay widths of the typical semileptonic and nonleptonic processes. Author

N72-31694# Nihon Univ., Tokyo (Japan). Dept. of Physics.
ON THE INTERACTION OF EXTENDED PARTICLES. 2: CONSTRUCTION OF GENERAL VERTEX OPERATOR
Tetsuo Goto and Takashi Obara (Jr. Coll. of Technol., Mishima, Japan) [1972] 14 p refs
(NUP-A-72-10) Avail: NTIS HC $3.00

The interaction of the string model was studied, assuming that the breaking and connection of strings give rise to the interaction. The general vertex operator was obtained by making use of coherent states. This simplifies the calculation of scattering amplitudes. As an application of the general vertex operator, scattering amplitude in the crossed channel was calculated. Author

N72-31695*# California Univ., Los Angeles. Dept. of Physics.
DISPERSION DISCONTINUITIES OF STRONG COLLISIONLESS SHOCKS
F. V. Coroniti Mar. 1970 53 p refs Sponsored in part by NSF (Grants NGR-05-007-190)
(NASA-CR-122474; R-67) Avail: NTIS HC $4.75 CSCL 20H

Linear fluid equations are used to estimate wave train properties of strong collisionless shocks. Fast shocks exhibit several dispersion changes with increasing Mach number. For perpendicular propagation into a finite-beta plasma, an ion cyclotron radius trailing wave train exists only for (M sub F)2 is smaller than 2. Oblique fast shocks have a leading ion inertia wave train if M sub A is smaller than root of M(+)/M(-) cos theta/2 and a trailing electron inertia train if M sub A is greater than root of M(+)/M(-) cos theta/2. If the downstream sound speed exceeds the flow speed, linear wave theory predicts a trailing ion acoustic structure which probably resides within the magnetic shock. For a turbulent shock model in which an effective electron-ion collision frequency exceeds the lower hybrid frequency, ions decouple from the magnetic field; the shock wave train now trails with electron inertia and electron gyroradius lengths. Comparisons of this turbulent model and observations on the earth's bow shock are made. Author

N72-31696# Hamburg Univ. (West Germany).
DOUBLE PION PRODUCTION WITHOUT ANNIHILATION IN ANTIPROTON-PROTON EXCHANGE EFFECTS AT 12 GeV/c Ph.D. Thesis [ZWEIFACH-PION-ERZEUGUNG OHNE ANNIHILATION IN ANTIPROTON-PROTON-WECHSELWIRKUNGEN BEI 12 GeV/c]
Gerhard Drews 1971 140 p refs In GERMAN
Avail: NTIS HC $9.00

Double pion production is studied in 1098 events of the reaction antiproton yields antiproton proton positive pion negative pion at an effective cross section 2.35 plus or minus 0.25 mb. Besides a strong production of hyperon resonance (++) isobar pair and its antiparticle, neutral rho meson production is probable. An indication for higher isobar production at mass 1.7 GeV is observable in invariant mass distributions for the systems proton positive pion negative pion and antiproton positive pion negative pion. A one pion exchange model with off-shell absorption corrections is formulated for the double isobar production process and the energy dependence of reaction antiproton proton yields antihyperon resonance (++) hyperon resonance (++). Transl. by G.G.

N72-31697# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
RHO MESON/PHOTON ANALOGY AND RHO MESON SUPPRESSION IN ANTIPROTON NEUTRON (AT REST) YIELDS 3 PIONS
A. Rothery Jul. 1972 13 p refs
(LPTHE-72/25) Avail: NTIS HC $3.00

A simple model of rho meson/photon analogy predicts a suppression of the rho meson in the final state of antiproton neutron (at rest) yields 3 pions, as observed. The relative suppression of the rho meson and rho vector mesons is quantitatively compared with phenomenological analysis. Author

N72-31698# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).
FIXED POLES IN THE t-CHANNEL HELICITY FLIP AMPLITUDE IN CHARGE AND HYPERCHARGE EXCHANGE REACTIONS
J. Gabarro and C. Pajares [1972] 46 p refs
(LPTHE-72/21) Avail: NTIS HC $4.50

Evidence for fixed poles in two body meson baryon scattering is studied. The contributions of wrong signature fixed poles occur in wrong signature sum rules. Evaluated is the first wrong signature sum rule for the t-channel helicity flip amplitude in pion nucleon anti kaon nucleon charge exchange and in hypercharge exchange scatterings. According to recent theoretical analysis the J = O antikaon nucleon charge exchange wrong signature fixed pole is generated, via t-channel unitarity, from the pion nucleon one. Its existence implies a spin = O antikaon nucleon charge exchange right signature fixed pole. Evidence for the existence of a spin = O wrong signature fixed pole is found in all of them. It is also found that the nonperipheral resonances are mainly responsible for all fixed poles. Author

N72-31699# Technische Univ., Berlin (West Germany).
RAINBOW SCATTERING OF PROTONS ON RARE GASES AND MOLECULES Ph.D. Thesis [REGENBOGENSTREUUNG VON PROTONEN AN EDELGASEN UND MOLEKUELEN]
Hans-Ulrich Mittmann 1971 79 p refs In GERMAN
Avail: NTIS HC $6.00

Elastic scattering of slow protons on helium, neon, argon, and on the molecules N2, CO, CO2, SF6, H2, and CH4 was studied. Measurements on the effective differential cross section rainbow structure were used to determine the attracting part in the particle potentials, the potential depths and the potential distance equilibria. Transl. by G.G.

N72-31700# Technische Univ., Berlin (West Germany).
STUDIES ON ION EXCHANGE KINETICS FOR THE LINDE MOLECULAR SIEVE TYPE A Ph.D. Thesis [UNTERSUCHUNGEN ZUR IONENAUSTAUSCHKINETIK AN LINDE MOLEKULARSIEB TYP A]
Harald Fischbach 1971 111 p refs In GERMAN
Avail: NTIS HC $7.75

A quantitative description of the ion exchange process time for the Ba-A plus Sr(++) reversible reaction Sr-A plus Ba(++) and Ca-A plus Sr(++) reversable reaction Sr-A plus Ca(++) (A = zeolith) is given by using the extended Helfferich theory that incorporates the dependence of the self-diffusion coefficient on the composition of the exchange phase as well as on the selectivity and the grain size distribution. Ion exchange kinetics calculations for Sr yields Ba- and Ba yields Sr-exchange ions agree well with exchange curves measurements. For the case Ca yields Sr- and Sr yields Ca- exchange ions a satisfying fit was not obtained and it is assumed that ion coupling over water molecules is responsible for this effect. Transl. by G.G.

N72-31701# Hamburg Univ. (West Germany).
THE REACTIONS PION(PLUS) PROTON YIELDS RHO(0) MESON DELTA(PLUS PLUS) HYPERON AND PION(PLUS) PROTON YIELDS f MESON DELTA(PLUS PLUS) HYPERON AT 11.7 GeV/c BEAM IMPULSE Ph.D. Thesis [DIE REAKTIONEN PION(PLUS) PROTON YIELDS RHO(0) MESON DELTA(PLUS PLUS) HYPERON UND PION(PLUS) PROTON YIELDS f MESON DELTA(PLUS PLUS) HYPERON BEI 11.7 GeV/c STRAHLIMPULS]
Hansjoerg Nagel 1971 141 p refs In GERMAN

Avail: NTIS HC $9.25

It is shown that quasi-two-particle reaction products of pion(+) proton yields pion(+) proton pion(+) pion (-) are separable by longitudinal impulses of ejected particles from center-of-mass systems. Separations are more precise at higher center-of-mass point energies with minimal resonance masses and increasing impulse transfer quadrupole moments. Effective production cross sections for the reactions pion(+) proton yields neutral rho meson Delta(++) and pion(+) proton yields f meson Delta(++) are determined by the t-dependence of matrix elements for both reactions; good agreements with the pion operator are obtained. Evaluation of decay angle distribution in neutral rho meson Delta(++) mass region shows that for t larger than 0.2 GeV squared, natural parity exchange can be dropped; the t-dependence of spin density matrix elements at small impulse transfers agrees well with the one-pion-exchange-model. Transl. by G.G.

N72-31702# Hamburg Univ. (West Germany).

THE ELECTROMAGNETIC PROTON FORM FACTORS AT IMPULSE TRANSFERS BETWEEN 0.6 AND 3.0 (GeV/c)2 Ph.D. Thesis [DIE ELEKTROMAGNETISCHEN PROTON-FORMFAKTOREN BEI IMPULSUEBERTRAEGEN ZWISCHEN 0.6 UND 3.0 (GeV/c)2]

Dirk Harms 1971 80 p refs In GERMAN

Avail: NTIS HC $6.00

Effective cross sections in elastic scattering of high energy electrons on free protons are used to determine the electric and magnetic proton form factors. Results show that the electric proton form factor decreases faster than the magnetic form factor at impulse transfer above q/2 = 1.5 (GeV/c)2. It is found that neither the vector dominance model, the quark model, nor the Veneciano model explain the q/2 course of the nucleon form factor. Studies of the reaction e + p yields e + p + pleaton in the missing mass region M sub p smaller than or equal to M(p + pleaton) smaller than or equal to M sub pion find the scattered electron at an angle of 12 deg at impulse transfer of 1.0 (GeV/c)2. Transl. by G.G.

N72-31703# Institut Franco-Allemand de Recherches, St. Louis (France).

AN ION (BOMBARDMENT) SOURCE COMBINING ALPHA PARTICLES AND ELECTRONS AND THE CATHODE EFFECTS IN THE PRESENCE OF OXYGEN [EINE KOMBINIERTE ALPHA, E-STOSSE-IONENQUELLE UNE IHRE KATHODENEFFEKTE BEI SAUERSTOFFEINLASS]

F. Daeublin 25 Nov. 1970 34 p refs In GERMAN

(ISL-23/70) Avail: NTIS HC $3.75

It is possible to achieve mass spectra with a cold cathode (alpha bombardment) or a hot cathode (electron bombardment) by using an alpha particle and electron bombardment device. The same device can measure the pressure in the ion source. The performance characteristics and disadvantages of the source are also presented. The sensitivity of the source is only 10 to the minus ninth A/mm Hg for air. It is possible to achieve better sensitivity by increasing the aperture angle of the beam and the intensity of the source with a radioactive preparation. It is concluded that a 2x10 to the minus seventh A/mm Hg sensitivity for air could be attained for an alpha particle bombardment ion source. ESRO

N72-31704# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).

SCATTERING OF MOLECULAR OXYGEN ON BARIUM AND STRONTIUM ATOMS IN A SUPERSONIC MOLECULAR BEAM APPARATUS [REAKTIVE STREUUNG VON O2 AN BA-UND SR-ATOMEN IN EINER UEBERSCHALL-MOLEKULARSTRAHLAPPARATUR]

Cristiano Batalli-Cosmovici Mar. 1972 137 p refs In GERMAN

(MPI-PAE/Extraterr-62) Avail: NTIS HC $9.00

The activation energies and the scattering cross sections are determined for barium, using an oxygen hypersonic crossed molecular beam apparatus. The equipment consists of two vacuum chambers for the oxygen jet, a scattering chamber containing an oven for the thermal metal vapor jet, and a revolvable quadrupole mass spectrometer. The reactions Ba + O2 yields BaO + O and also Sr + O2 yields SrO + O are studied as reactive scattering processes, in which the relative collision energy can be increased to 1 eV. The activation energy for the formation of BaO is lower than 0.09 eV and the reactive scattering cross section for colliding end products in electronic ground state is 0.7 sq A for a collision energy of 0.3 eV and 0.4 sq A for 0.92 eV (error of approximately 50 %). The dissociation energy of SrO in 4.8 eV, and the reactive cross section is a factor of 10 larger than Ba + O2. ESRO

N72-31705# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

ROTATIONAL TEMPERATURE MEASUREMENTS IN NITROGEN EXCITED BY ELECTRON BEAMS. PRACTICAL APPLICATIONS OF THE SMITH MODEL [MESURES DE TEMPERATURE DE ROTATION DANS L'AZOTE EXCITE PAR FAISCEAU ELECTRONIQUE. UTILISATION PRATIQUE DU MODELE DE SMITH]

Jean-Claude Lengrand and Michel Cloupeau Apr. 1972 72 p refs In FRENCH; ENGLISH summary

(Rept-72-2) Avail: NTIS HC $5.75

The principle of local rotational temperature measurements in low-density nitrogen flows, the Muntz theory for processing spectroscopic measurement data, and Smith's model which accounts for secondary electron effects are reviewed. A method somewhat different from Smith's is proposed where all constants are calculated numerically, which avoids approximations. The remaining parameter is determined experimentally. It is shown that it depends essentially on density, which is generally known from flow field measurements with an electron beam probe. Tables of numerical values for various constants are included.

Author (ESRO)

N72-31706# European Space Research Inst., Frascati (Italy).

ON THE BREADTH OF THE NITROGEN K SHELL EXCITATION LINE AS OBSERVED BY ESCA AND XUV ABSORPTION SPECTROSCOPY

J. P. Connerade, M. W. D. Mansfield, and K. Thimm (Bonn Univ.) 1972 9 p refs Submitted for publication

Avail: NTIS HC $3.00

An anomaly between nitrogen K shell excitation line widths observed by ESCA, X-ray and optical absorption techniques was investigated, and is shown to be partly attributable to saturated absorption in the photon spectra. An explanation for the remaining discrepancy is discussed. The measurements were made using optical techniques on the background radiation continuum of the 2.5 GeV Bonn synchrotron. A sequence of exposures was taken at various nitrogen gas pressures.

Author (ESRO)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-31707# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).

TRANSVERSE DYNAMIC STABILIZATION OF A THETA PINCH

G. G. Lister, F. S. Troyon, and E. S. Neibel Jun. 1972 32 p refs

(LRP-51/72) Avail: NTIS HC $3.75

The stability of a straight plasma column confined by a static axial magnetic field and a small oscillating transverse magnetic field is discussed. Growth rates for the most important parametric instabilities are obtained. The influence of damping in

providing a stabilizing mechanism against these instabilities is discussed and a set of stability criteria obtained using a viscous fluid model for the plasma. The possibility of suppressing the fastest growing instability by wobbling the frequency of the applied field is also discussed. An order of magnitude calculation for dynamic stabilization of a toroidal plasma is presented.
Author

N72-31708# Nagoya Univ. (Japan). Inst. of Plasma Physics.
IONIZATION OF ENERGETIC NEUTRAL ATOMS ON A METALLIC SURFACE
Tadao Honzawa Jun. 1972 15 p refs
(IPPJ-129) Avail: NTIS HC $3.00

An experimental study is described on the ionization of energetic neutral atoms on an untreated, metallic surface. The energy loss associated with the ionization was found to depend strongly on the incident angle of the particles onto the surface. The efficiency of ionization is of the order of 0.000001. Angular distribution of the ions leaving the surface was also measured.
Author

N72-31709# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SYSTEM OF INNER CURRENT ANNULI ARRANGED ALONG THE MINOR AXIS OF A TORUS
Akihiro Mohri and Taijiro Uchida Jun. 1972 30 p refs
(IPPJ-127) Avail: NTIS HC $3.50

A magnetic field configuration produced by immersing poloidal current rings in a toroidal magnetic field is examined, covering a wide range of parameters: number of the rings, aspect ratio of the ring, and amount of the ring current. Owing to the toroidal effect, null field lines shift from their original positions in case of the linear configuration. An averaged magnetic well is formed around the separatrix and local magnetic shear appears due to the toroidal effect. Cases are considered for which the current in the ring is induced by the time variation of the toroidal field. Minimum B may be formed when the number of the ring exceeds a value given by the aspect ratio.
Author

N72-31710*# California Univ., Los Angeles. Plasma Physics Group.
LAMINAR WAVE TRAIN STRUCTURE OF COLLISIONLESS MAGNETIC SLOW SHOCKS
F. V. Coroniti Sep. 1970 59 p refs
(Grants NGR-05-007-190)
(NASA-CR-122475; R-76) Avail: NTIS HC $5.00 CSCL 20I

The laminar wave train structure of collisionless magnetic slow shocks is investigated using two fluid hydromagnetics with ion cyclotron radius dispersion. For shock strengths less than the maximally strong switch-off shock, in the shock leading edge dispersive steepening forms a magnetic field gradient, while in the downstream flow dispersive propagation forms a trailing wave train; dispersion scale lengths are the ion inertial length if beta is smaller than 1 and the ion cyclotron radius if beta is greater than 1. In the switch-off slow shock leading edge, dispersion only produced rotations of the magnetic field direction; the gradient of the magnetic field magnitude, and hence the shock steepening length, is determined solely by resistive diffusion. The switch-off shock structure consists of a long trailing of magnetic rotations which are gradually damped by resistivity.
Author

N72-31711# Joint Publications Research Service, Arlington, Va.
RELAXATION PROCESSES IN A JET OF LOW-TEMPERATURE ARGON PLASMA WITH CO2 IMPURITIES
I. A. Aliyeva and N. I. Yushchenkova 29 Aug. 1972 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekh. Mat. Nauk (Azerbaidzhan SSR),. no. 6, 1970 p 121-125
(JPRS-56902) Avail: NTIS HC $3.00

The processes of relaxation of the electron temperature are investigated in a stream of low-temperature plasma in calculating the electrophysical parameters of the current in the nozzles of magnetogas-dynamic generators and aerodynamic plasma installations.
Author

N72-31712# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
CRYSTALLIZATION OF THE CLASSICAL ONE-COMPONENT PLASMA
J. P. Hansen Jul. 1972 6 p refs
(LPTHE-72/32) Avail: NTIS HC $3.00

The melting line of a classical one-component plasma was determined by computing the free energies of the fluid and solid phases from exact Monte Carlo equations of state.
Author

N72-31713# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
EXPERIMENTAL INVESTIGATION OF THE MICROINSTABILITY IN THE PISTON-REGION OF A MAGNETOSONIC SHOCK WAVE
Helmut Niedermeyer Jul. 1972 62 p refs In GERMAN, ENGLISH summary
(IPP-1/118) Avail: AEC Depository Libraries

A microinstability responsible for anomalous magnetic field diffusion and collisionless dissipation in magneto acoustic compression waves was investigated experimentally. In a radially homogeneous plasma column generated by UV. preionization compression waves were exited by a fast theta pinch fed by a Blumlein line. The time development of the magnetic field profile measured by a fast miniature probe showed an anomalous field diffusion in the region of the magnetic piston. Electric field fluctuations with amplitudes of 5 kV/cm were measured spectroscopically by the helium satellite method. A numerical study of the linear dispersion relationship predicts electroncyclotron waves to be the most unstable ones, with frequencies and growth rates corresponding to the observed values.
Author (NSA)

N72-31714# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
PRELIMINARY STUDY OF A PHOTOIONIZED-BARIUM PLASMA SOURCE FOR W2 A STELLARATOR
S. Ishii and W. Ohlendorf Oct. 1971 28 p refs
(IPP-2/200) Avail: AEC Depository Libraries

A source of photoionized barium from metastable atoms was developed for study on the W2a stellarator. An ion flux of 2 x 10 to the 12th power/sec is obtained.
Author (NSA)

N72-31715# Kiel Univ. (West Germany). Institut fuer Experimentalphysik.
INVESTIGATIONS ON THE SHOCK TUBE
H. Carls, H. Haase, and W. Zuzak Oct. 1971 78 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-71-13) Avail: AEC Depository Libraries

Investigations were made of plasmas generated in a conventionally driven shock tube. Mainly spectroscopic and interferometric techniques were used. The establishment of local thermodynamic equilibrium is discussed.
Author (NSA)

N72-31716# Institute of Nuclear Research, Warsaw (Poland).
MEASUREMENT OF TEMPERATURE BY RECORDING THE ABSOLUTE LINE INTENSITY FOR APPARENT INCREASE OF PLASMA OPTICAL THICKNESS
Szymon Suckewer 1971 9 p refs Submitted for Publication
(INR-P-1355) Avail: AEC Depository Libraries

The possibilities of measurements of temperature by recording absolute line intensity, using the apparent increase of optical thickness of a plasma placed between two parallel mirrors, are

discussed. The analysis of spectral line contours for increasing optical thickness is given. The diagram of the measuring instrument is discussed. Author (NSA)

N72-31717# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT Monthly Progress Report, 1 Jul. - 31 Dec. 1971
31 Dec. 1971 9 p refs
(NP-19248; MPR-22) Avail: AEC Depository Libraries

An account is given of research being carried out within the department. Particular mention is made of plasma sources, hydromagnetic ionizing fronts, plasma decay, rotating plasmas, cyclotron harmonic waves, hydromagnetic waves, laser diagnostics and far infrared. Author (NSA)

N72-31718# Institut Franco-Allemand de Recherches, St. Louis (France).
IONIZATION RELAXATION BEHIND A STRAIGHT SHOCK IN AIR [RELAXATION D'IONISATION DERRIERE UN CHOC DROIT DANS L'AIR]
G. Stern and E. Garaccio 7 Oct. 1971 71 p refs In FRENCH
(Contract DTEN-70.198)
(ISL-27/71) Avail: NTIS HC $3.75

Methods for measuring the ionization relaxation phenomenon behind a straight shock in air are described, and the experimental results are compared with a mathematical model. The shock wave was generated by a shock tube. A spherical mirror microwave Fabry-Perot resonator and a microwave focalizing optics interferometer functioning at 70 GHz were used for measurements. Both systems permit measurement in a range of 10 to the 8th to 10 to the 12th power 1/cu cm for a 10 cm plasma thickness. ESRO

N72-31719# European Space Research Inst., Frascati (Italy).
STABILIZATION OF RESISTIVE TWO STREAM INSTABILITY IN THE EQUATORIAL ELECTROJET BY TWO-DIMENSIONAL NONLINEAR PROCESSES
Andre Rogister and Eric Jamin 1972 35 p refs Submitted for publication
Avail: NTIS HC $3.75

The stabilization of the resistive two stream instability, which excites type 1 irregularities in the equatorial electrojet, occurs through both quasi-linear and nonlinear processes. The instability relaxes quasi-linearly to a state close to marginal stability. The residually unstable modes, propagating in a two-dimensional cone with axis in the east-west direction, then transfer energy through angular mode coupling into damped waves, propagating outside this cone, at a sufficient rate to maintain a steady level of turbulence. The turbulence is confined in a cone with non-negligible aperture and limited in wave number by (linear) electron finite Larmor radius stabilization. Author (ESRO)

N72-31720# European Space Research Inst., Frascati (Italy).
THE NON-LINEAR DEVELOPMENT OF THE TWO ION BEAM INSTABILITY
D. R. Baker 1972 44 p refs Submitted for publication
Avail: NTIS HC $4.25

The nonlinear development of the two ion beam (i-i) instability was investigated experimentally. The ion acoustic turbulence grows and stabilizes in conjunction with a significant change in the average ion distribution function. A quasi-linear type theory is developed for ion waves in a boundary value problem which appears to predict most of the observed nonlinear behavior of the instability including excited waves and the growth of the background noise. A brief discussion of trapping and strong turbulence effects is given. Author (ESRO)

N72-31721# Army Foreign Science and Technology Center, Charlottesville, Va.
SIMULTANEOUS COMBUSTION OF HIGH-CURRENT AND HIGH-FREQUENCY ARCS IN A PLASMATRON
V. A. Bogatyrova, N. I. Vorobeva, M. F. Zhukov, and Yu. I. Sukhinin 3 Feb. 1972 10 p ref Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, 1968 p 86-89
(AD-743111; FSTC-HT-23-823-71) Avail: NTIS CSCL 20/9

Certain problems of simultaneous combustion of high-current alternating and duty high-frequency arcs in a turbulent type plasmatron are examined. It is shown that the power arc in this case burns without current pauses with cos theta equal to 1. Author (GRA)

N72-31722# Texas Univ., Austin. Electronics Research Center.
DISPERSION OF ELECTROSTATIC ION PLASMA WAVES NEAR HARMONICS OF THE ION CYCLOTRON FREQUENCY
J. G. Melton and A. A. Dougal 22 Jan. 1972 124 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-743287; TR-119; AFOSR-72-0535TR) Avail: NTIS CSCL 20/9

Plasma waves which can propagate in a hot magnetized plasma near harmonics of the ion cyclotron frequency (Omega sub ci) were studied numerically in the electrostatic approximation. The effects of collisionless damping processes and finite ion Larmor radius were included. The results obtained were compared first to those obtained from common approximate equations, to determine when the approximate results are adequate to describe the waves, and then to the experimental results which have been obtained at several laboratories. Author (GRA)

N72-31723# Texas Univ., Austin. Electronics Research Center.
PLASMA HEATING NEAR THE ION CYCLOTRON FREQUENCY AND ITS HARMONICS
R. W. Clark and D. G. Swanson 1 Dec. 1971 135 p refs
(Contracts F44620-71-C-0091; AT(40-1)-3871; AF Proj. 4751)
(AD-743286; AFOSR-72-0407TR; TR-116) Avail: NTIS CSCL 20/9

Additions have been made to the theory of the Quasi Ion Bernstein modes which propagate for wave frequencies near the harmonics of the ion cyclotron frequency, and experience ion cyclotron damping as the harmonic resonances are approached. The effects of collisions and electron Landau damping have been included, and group velocity calculations have been performed. When the effects of collisions are included, the theory predicts strong collisional damping in high density, low temperature collision dominated plasmas, whereas the original theory predicted wave propagation in the absence of collisions. Author (GRA)

N72-31724# Texas Univ., Austin. Electronics Research Center.
PLASMA INJECTION AND COLLISION PHENOMENA IN AN OCTUPOLE MAGNETIC FIELD
J. L. Ligon and W. C. Duesterhoeft, Jr. 30 Aug. 1971 184 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-743007; JSEP-TR-109; AFOSR-72-0371TR) Avail: NTIS CSCL 20/9

Controlled thermonuclear fusion research requires the filling of containment devices with high temperature plasma. With one common filling method the plasma is created by plasma guns outside the confining field and then is injected into the containment region. The need exists for increasing the density and temperature of plasma that can be injected and trapped in containment devices. The work investigates transverse plasma injection into a linear octupole magnetic field by using two colliding plasmas for injection instead of the usual single plasma. Both two conical theta pinch and two coaxial plasma guns produce plasmas used in the experiments. The construction and operation of a conical theta pinch gun system is described, and a detailed study of the plasmas from this gun is presented. Experimental measurements with diagnostics such as magnetic

probes, unbiasted electric probes, and Faraday cup ion probes provide information along the octupole injection axis that describes the phenomena that occur when the two plasmas are injected and interact. A computer simulation of two-plasma injection into a magnetic field similar to the octupole field is carried out. Author (GRA)

N72-31725# Naval Research Lab., Washington, D.C.
THEORY AND SIMULATION OF TURBULENT HEATING BY THE MODIFIED TWO-STREAM INSTABILITY
John B. McBride, Edward Ott, Jay P. Boris, and Joseph H. Orens Apr. 1972 61 p refs
(AD-742756; NRL-MR-2428) Avail: NTIS CSCL 20/9

The authors present results of an analytical and numerical study of the nonresonant, modified plasma two-stream instability, which is driven by relative streaming of electrons and ions across a magnetic field B sub 0. The instability has characteristic frequency and growth rate comparable to the lower hybrid frequency. The linear theory is discussed both in the electrostatic and fully electromagnetic cases, and the authors present a detailed numerical study of the dependence of the unstable roots of the dispersion relation for a wide range of plasma parameters. Author (GRA)

N72-31726# Texas Univ., Austin. Plasma and Quantum Electronics Research Lab.
LASER INDUCED BREAKDOWN IN HIGH PRESSURE NOBLE GASES
Guy Walter Haynes and Arwin A. Dougal 30 Sep. 1971 144 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-743008; JSEP-TR-110; AFOSR-72-0199TR) Avail: NTIS CSCL 20/9

Laser induced breakdown is studied both experimentally and analytically in high pressure helium, neon, and argon gases. It is shown that an analysis based on balancing electron production against electron loss yields good agreement with experimental data for the gases studied. Experimentally a giant-pulse ruby laser was used for the pressure range from ten atmospheres to two thousand atmospheres. The model used in the analysis assumes that laser photons are absorbed by the process of inverse bremsstrahlung. Free electrons are produced by collisional ionization and from photoionization and associative ionization of excited neutrals. The data taken indicates a minimum in the plot of threshold field versus pressure for helium and argon and a possible minimum beyond the pressure system limits for neon. In the comparison of experimental data to theoretical calculations, non-ideal behavior of the gas and the change in index of refraction with gas pressure are taken into account. Author (GRA)

N72-31727# Army Foreign Science and Technology Center, Charlottesville, Va.
CORRELATION OF VOLT-AMPERE CHARACTERISTICS OF COAXIAL PLASMATRON WITH MAGNETIC ARC STABILIZATION
V. S. Kisel, B. A. Uryukov, and V. I. Yadrov 26 Aug. 1971 9 p refs Transl. into ENGLISH from Izv. Sib. Otd. Akad. Nauk SSSR (Novosibirsk, USSR), no. 8(2), 1967 p 105-108
(AD-742506; FSTC-HT-23-822-71) Avail: NTIS CSCL 20/9

The volt-ampere characteristics of a coaxial plasmatron with magnetic arc stabilization are analyzed for a broad range of change of gas flow rate, magnetic field and geometric dimensions. The findings are generalized on the basis of theory. Author (GRA)

N72-31728# Army Foreign Science and Technology Center, Charlottesville, Va.
CALCULATION OF TEMPERATURE FIELD IN PLASMATRON ELECTRODES
B. A. Uryukov 1972 19 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (Moscow), no. 5, 1967 p 84-91
(AD-742501; FSTC-HT-23-825-71) Avail: NTIS CSCL 09/1

A plasmatron electrode in the form of a hollow cylinder, on one surface of which travels the arc spot, the other of which is cooled, is examined. The spot is assumed to travel in a closed trajectory in one section of the electrode. Author (GRA)

N72-31729# Army Foreign Science and Technology Center, Charlottesville, Va.
CHARACTERISTICS OF PLASMATRON WITH INTERELECTRODE GAS INJECTOR
G. Yu. Daumov, Yu. S. Dudnikov, M. F. Zhukov, G. M. Mustafin, and M. I. Sazonov 1972 13 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 1, 1967 p 172-176
(AD-742886; FSTC-HT-23-824-71) Avail: NTIS CSCL 20/9

The volt-ampere and thermal properties of a plasmatron with a sectional interelectrode gas injector, oscillograms of pulsations of arc voltage and brightness of the heated gas flow are presented in the article. The characteristics are compared with the analogous characteristics of the single-chamber plasmatron. Author (GRA)

N72-31730# Air Force Systems Command, Wright-Patterson AFB, Ohio.
MEASUREMENTS IN PLASMA DIAGNOSTICS USING A MACH-ZEHNDER INTERFEROMETER
Vaclav Iadislav Exner 3 Apr. 1972 25 p refs Transl. into ENGLISH from Cesk. Cas. Fys. (Czechoslovakia), v. 20, no. 4, 1970 p 396-412
(AD-743142; FTD-HC-23-1847-71) Avail: NTIS CSCL 20/9

In the paper the principle of the optical interference method is described and formulas for determining the value of the interference fringes shift are derived. Dispersion equations stating the relation between the refractive index N and the gas density P, the given free electrons concentration, and the product of the concentration of excited atoms in the state I and the respective strength of the given oscillator are presented. A Mach-Zehnder interferometer is the most frequently used apparatus for the interference measurements of these quantities. The interferometer with a crossed spectrograph using white light according to Rozhdyestvenskiy is described. Author (GRA)

N72-31731# Office of Naval Research, London (England).
IAEA-ENEA LIAISON GROUP MEETING ON MHD
Michael Petrick and John A Satkowski 12 Apr. 1972 29 p Conf. held at Moscow, 7-15 Dec. 1971
(AD-742762; ONRL-C-7-72) Avail: NTIS CSCL 20/9

A primary purpose of this Liaison Group meeting was to review and to complete the test for the 1972 status report on MHD Electrical Power Generation. An equally important purpose was to review national programs on MHD research and development. The Group reviewed the Soviet program in detail and toured the major MHD facilities of the Krzhizhanovsky Power Institute, High Temperature Institute and the Kurchatov Atomic Energy Laboratories. Author (GRA)

N72-31732# Naval Research Lab., Washington, D.C. Plasma Dynamics Branch.
ION-ION INSTABILITY INDUCED BY ac ELECTRIC FIELDS
Konstantions Papadopoulos and John B. McBride Jun. 1972 16 p refs
(AD-743886; NRL-MR-2448) Avail: NTIS CSCL 20/9

The presence of low frequency a.c. fields in a plasma substantially modifies the marginal stability condition for a counterstreaming ion-ion instability and allows the system to be unstable even if the electron thermal energy is much smaller than the relative ion streaming energy. The possible role of the instability in high Mach number whistler shocks is discussed. Author (GRA)

N72-31733# Northrop Corp., Hawthorne, Calif. Laser Systems Dept.
ELECTRON DENSITY IN AN ELECTRON BEAM STABILIZED HIGH PRESSURE DISCHARGE
Benedict B. OBrien, Jr. Mar. 1972 47 p refs
(Contract N00014-72-C-0043; ARPA Order 1806)
(AD-743222; NLSD-72-8R) Avail: NTIS CSCL 20/9

The basic differential equations for the electron beam stabilized discharge are formulated and a discussion of the relevant physical processes is presented. Rapid charge transfer among the positive ions is shown to result in a considerable simplification of the basic equations. An analytic solution is given which, in an approximate manner, includes the effect of oxygen attachment. A comparison between calculated electron densities and preliminary measurements is shown to be in reasonable agreement. Author (GRA)

N72-31734# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ION SIMULATION MODEL FOR MAGNETIC MIRROR MACHINES
Louis A. Tamburino Feb. 1972 46 p refs
(AF Proj. 7114)
(AD-742986; ARL-72-0027) Avail: NTIS CSCL 20/9

A computer model for finite plasmas in a magnetic mirror machine is described. Ion simulation particles take the form of concentric sheets which are finite and flexible with curved contours. Radial dynamical equations are obtained by starting with the Boltzmann equation, and are coupled with suppressed degrees of freedom and finite boundaries. An auxiliary orbit model, which includes effects of finite ion Lamour radii, is used to estimate azimuthal velocity averages from the radial density profile and radial velocity averages generated by the sheet model. Simulated ion loss can take place through the radial boundary and magnetic mirrors. Author (GRA)

N72-31735# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
MEASUREMENT OF THE SELF-ABSORPTION OF A PLASMA CONFINED IN A TUBE
Richard D. Franklin and Wolfgang G. Braun Mar. 1972 20 p refs
(AF Proj. 7073)
(AD-742987; ARL-72-0031) Avail: NTIS CSCL 20/9

An experimental arrangement for the determination of the local coefficient of absorption of a rotationally symmetric plasma column located centrally in a transparent cylinder is described. A beam of radiation emitted from the central zone of the plasma is used for the measurement of the transmission factor of the plasma in the envelope as a function of the distance of the probing ray from the axis of the column. The scanning system which is readily adaptable to various tube parameters is assembled from commercially available components. Relations are given connecting the object (plasma) and image (confined plasma) distributions of the transmission factor. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-31736*# Stanford Univ., Calif. Microwave Lab.
THE EFFECT OF THE NONUNIFORM dc FIELD ON CARRIER WAVES IN NEGATIVE DIFFERENTIAL MOBILITY SEMICONDUCTORS
M. Bini 1971 10 p refs
(Grant NGL-05-020-165)
(NASA-CR-122517) Avail: NTIS HC $3.00 CSCL 20L

The growth of a carrier wave propagating through a negative differential mobility semiconducting sample is discussed under nonuniform dc bias conditions. A simple analytical expression for the overall numerical gain is given in terms of current density and of the input and output carrier wave velocities only. Applications to n-type GaAs are discussed. Author

N72-31737# Istituto Superiore di Sanita, Rome (Italy).
PHOTOCONDUCTIVE AND PHOTOVOLTAIC EFFECTS IN THE INDIRECT GAP REGION OF GaS
M. Grandolfo and G. Mariutti 20 Nov. 1971 19 p refs In ITALIAN; ENGLISH summary
(ISS-71/33) Avail: NTIS HC $3.00

The preliminary results obtained in the detection of the photovoltaic effect and of the photoconductive response of GaS single-crystals are reported. Measurements were performed at room temperature and a phase sensitive amplifier has been used to reveal the signal caused by a periodic modulation of the illumination intensity. Author

N72-31738# Helsinki Univ. of Technology, Otaniemi (Finland).
OPW ENERGY BAND OF TRIGONAL SELENIUM
Juhani VonBoehm, Peter Krusius, Eero Suosara, and Erkki Laurila, ed. Helsinki Finnish Acad. of Tech. Sci. 1972 31 p refs
(APS-Ph-86; ISBN-951-666-003-7) Avail: NTIS HC $3.75

The nonrelativistic electronic energy band structure of trigonal selenium was determined using the symmetrized OPW method and a constructed crystal potential. The results obtained are most similar to the pseudopotential bands of Picard and Hulin. The overall band structure agrees with experiment, but the energy gap obtained is not satisfactory. Author

N72-31739*# Tyco Labs., Inc., Waltham, Mass.
THICK FILM SILICON GROWTH TECHNIQUES Quarterly Progress Report, 18 Feb. - 31 May 1972
H. E. Bates, F. H. Cocks, and A. I. Mlavsky 31 May 1972 33 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953365)
(NASA-CR-128111; QPR-1) Avail: NTIS HC $3.75 CSCL 20L

Thick film silicon ribbons were produced by means of the edge-defined, film-fed growth (EFG) technique. EFG is a process by which single crystals may be grown having a shape controlled by the outside dimesions of a die, the growth taking place from an extremely thin film of liquid fed by capillary action from a crucible below. The principal problem to be overcome in the application of this process to the growth of thick film silicon ribbon relates to the material, such as the shaping die. For the method to operate, this die material must be wet by the liquid silicon. To preserve semiconductor quality, the liquid silicon must not react significantly with the die material. The most promising die material for this application appears to be SiC and SiC-SiO2 admixture. In this case good wetting occurs between the molten silicon and the SiC. C is a relatively unharmful contaminant of Si and additions of quartz to SiC are found to decrease the extent of reaction. Author

N72-31740*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWISTED MULTIFILAMENT SUPERCONDUCTOR Patent Application
Willard D. Coles, inventor (to NASA) Filed 11 Aug. 1972 14 p
(NASA-Case-LEW-11726-1; US-Patent-Appl-SN-280031) Avail: NTIS HC $3.00 CSCL 20L

Masking selected portions of a ribbon and forming an intermetallic compound on the unmasked portions by a controlled diffusion reaction produces a twisted filamentary structure. The masking material prohibits the formation of superconductive material on predetermined areas of the substrate. NASA

N72-31741# National Bureau of Standards, Washington, D.C.
CRYSTAL STRUCTURE TRANSFORMATIONS IN BINARY HALIDES
C. N. R. Rao (Indian Inst. of Tech., Kanpur) and M. Natarajan (Indian Inst. of Tech., Kanpur) Jul. 1972 54 p refs
(NSRDS-NBS-41) Avail: SOD $0.55 as C 13.48:41

A critical survey of the data describing crystal structure transformations in binary halides is compiled. Data on thermodynamic, crystallographic, spectroscopic and electronic properties are given for each transformation. Experimental techniques used to obtain the data are named and comments on the data are included in the tables. The literature is surveyed up to 1970. References have been selected on the basis of their pertinence to the data which are cited and do not represent all the available literature. Author

N72-31742*# National Bureau of Standards, Washington, D.C. Electronic Technology, Div.
METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Jan. - 31 Mar. 1972
W. Murray Bullis, ed. Sep. 1972 60 p refs Supported in part by Navy, AF, and AEC
(NASA order S-70003-G; DNA Order EA072-810; ARPA Order 1889)
(NASA-CR-128049; QPR-15; NBS-TN-733) Avail: NTIS; SOD $0.60 as C13.46:733 CSCL 20L

Significant accomplishments include development of a procedure to correct for the substantial differences of transistor delay time as measured with different instruments or with the same instrument at different frequencies; association of infrared response spectra of poor quality germanium gamma ray detectors with spectra of detectors fabricated from portions of a good crystal that had been degraded in known ways; and confirmation of the excellent quality and cosmetic appearance of ultrasonic bonds made with aluminum ribbon wire. Work is continuing on measurement of resistivity of semiconductor crystals; study of gold-doped silicon, development of the infrared response technique; evaluation of wire bonds and die attachment; and measurement of thermal properties of semiconductor devices, delay time and related carrier transport properties in junction devices, and noise properties of microwave diodes. Author

N72-31743# Technische Univ., Berlin (West Germany).
POLARIZATION-ULTRAVIOLET-ABSORPTION SPECTROMETRIC STUDIES ON ELECTRONIC AND GEOMETRIC STRUCTURE OF THE OCTACYONO COMPLEXES IN FOUR- AND FIVE-VALANCE MOLYBDENUM AND TUNGSTEN Ph.D. Thesis [POLARISATIONS-UVABSORPTIONSSPEKTROMETRISCHE UNTERSUCHUNGEN ZUR ELEKTRONISCHEN UND GOEMETRISCHEN STRUKTUR DER OKTACYANOKOMPLEX DES VIER- UND FUENFWERTIGEN MOLYBDAENS UND WOLFRAMS]

Peter Morys 1971 160 p refs In GERMAN
Avail: NTIS HC $10.00

Ultraviolet-polarization absorption spectra and theoretical models were used to determine the band structure of single crystal four- and five-valence molybdenum and tungsten octacyano complexes in the spectral region 10 to 50 kK. A special developed microcrystal absorption spectrometer provided single crystal spectra for a detailed interpretation of their electronic structure. A semi-empirical theory for octacyono complexes was developed based on the d orbital of the central metal ion as well as on the sigma sub 1-, sigma sub 2-, pion -, and pion resonance-valence orbitals of the eight negative CN-ligands. The coordination structure for complex ions in solutions was between the almost ideal dodecahedral structure of solid complexes at room temperature and the intermediate ion structure at 20 K. The coordination structure of all investigated octacyano complexes was of the D sub 2 symmetry. It was assumed that this is the basic symmetry which only changes into antiprismatic and dodecahedral coordinates under the influence of exterior forces.
Transl. by G.G.

N72-31744# Technische Univ., Berlin (West Germany).
OPTICAL REFLECTION AND BAND STRUCTURE OF ZnS(1 MINUS x) Se(x) MIXED CRYSTALS Ph.D. Thesis [OPTISCHE REFLEXION UND BANDSTRUKTUR VON ZnS(1-x)Se(x)-MISCHKRISTALLEN]
Klaus-Erik Kirschfeld 1971 49 p refs In GERMAN
Avail: NTIS HC $4.50

Optical reflection measurements on ZnS(1-x)Se(x) mixed cubic crystals provide characteristic band structures and energy transformations at room temperatures. It is observed that ZnSe complex bands lie energetically about 0.3 eV higher than corresponding bands in ZnS complexes and that the ZnS band exhibits a localized perturbation term at lattice point 0.25 above the upper valence band edge at weak selenium doping. At a concentration of x = 0.001 Mo1/Mo1 the selenium perturbation band becomes pronounced k-dependent and overlaps already at a concentration of x = 0.01 Mo1/Mo1 with the valence band of the unperturbed ZnS lattice. Increased selenium content broadens the perturbation bands and at the same time contracts the sulphur bands. It is approximated that about 6% of the overall selenium content is located in intermediate lattice points of a secondary selenium perturbation band in pure ZnSe crystals.
Transl. by G.G.

N72-31745# Technische Univ., Berlin (West Germany).
ON CHEMICAL AND ELECTRICAL PROPERTIES OF MIXED OXIDE CRYSTALS CONTAINING IRON AND TITANIUM Ph.D. Thesis [UEBER KRISTALLCHEMISCHE UND ELEKTRISCHE EIGENSCHAFTEN EISEN UND TITAN ENTHALTENDER MISCHOXIDE]
Gunter Buxbaum 1971 120 p refs In GERMAN
Avail: NTIS HC $8.00

Production kinetics and lattice dimensions of the spinel mixed-crystal series ZnFe(x)Ti(2-x)04 and Fe(y)Ti(2-y)03 were studied. Seebeck coefficients and electrical resistances were used to find electronic charge carrier transport properties. Activation energies for the mixed crystal series Fe(y)Ti(2-y)03 were 0.20 smaller than or equal to q smaller than or equal to 0.40 eV at temperatures greater than 200 K, and 0.05 smaller than or equal to q smaller than or equal to 0.20 eV at temperatures smaller than 125 K in the region 0.95 smaller than or equal to y smaller than or equal to 1.05 with a maximum at y = 1.0. Activation energies for the mixed crystal system ZnFe(x)Ti(2-x)04 were not determined. The potential charge distribution in both mixed crystal systems was iron (II) next to titanium (IV).
Transl. by G.G.

N72-31746# Technische Univ., Berlin (West Germany). Fachbereich fuer Synthetische und Analytische Chemie.
ON THE FORMATION KINETICS OF GALLIUM SPINELS Ph.D. Thesis [ZUR BILDUNGSKINETIK VON GALLIUM-SPINELLEN]
Wolfgang Laqua 1971 236 p refs In GERMAN
Avail: NTIS HC $14.00

The reaction mechanism for gallium spinel formation is studied through interactions between NiO, MgO or CoO with Ga2O3 at 1230 to 1550 C. X-ray and phase transformation observations show that: (1) NiGa2O2 is formed by the transport of Ni(2+) and O(2-) through the reaction products; (2) MgGa2O4 is formed by opposite cation diffusion with parts of a similar flow of Mg(2+) and O(2); and (3) CoGa2O4 is formed by Co(2+) and O(2-) transport through the reaction product to the Ga2O3 phase boundary.
Transl. by G.G.

N72-31747# Technische Univ., Berlin (West Germany).
HIGH RESOLUTION ELECTRON- AND ENERGY-LOSS ANALYSIS ON THIN GERMANIUM- AND SILICON-LAYERS IN THE INFRARED SPECTRAL REGION Ph.D. Thesis [HOCHAUFGELOESTE ELEKTRONEN- ENEGIEVERLUSTANALYSE VON DUENNEN GERMANIUM- UND SILICIUM-SCHICHTEN IM INFRAROTEM SPEKTRALBEREICH]
Bernd Schroeder 1971 86 p refs In GERMAN
Avail: NTIS HC $6.50

Energy spectra of thin germanium and silicon layers were determined by high resolution spectrometry at 0.02 to 3 eV. Spectrum analysis attributed energy losses to excitations by phonons, intra- and inter-band transformations, and absorption by free charge carriers. Lattice defects increased the excitation probability of multiple phonon processes. Dielectric constant calculations showed that fast electrons in thin layers excited mostly excited surface phonons. The germanium interband transformations were strongly effected by amorphic layer structure; intraband transformation intensities depended on charge carrier concentration. Polycrystalline germanium layers exhibited much more intensive energy continuae and weaker singular excitations.
Transl. by G.G.

N72-31748# Technische Hochschule Munchen (West Germany).
MAGNETIC SECOND ORDER EXCHANGE EFFECTS IN THULIUM COMPOUNDS Ph.D. Thesis [MAGNETISCHE WECHSELWIRKUNGEN ZWEITER ORDNUNG IN VERBINDUNGEN VON THULIUM]
Ernst Richard Seidel 1971 99 p refs In GERMAN
Avail: NTIS HC $7.00

A semi-crystalline field theory and group theoretical observations are used to analyze the systematic appearance of adjoining crystal field singlets as lowest states in several low-symmetry thulium compounds. The immediate environment of the Tm-ion produces an approximately axisymmetrical electrical field superimposed by low symmetry components. These components with their large spin impulse of J = 6 for the doubly degenerated ground state are delayed effective and their characteristic secondary magnetic exhange effects are studied by Mossbauer and magnetization measurements. Magnetic ordering is observed in a nonconducting Tm compound, Tm(S04)3 x 8 H20, with T = (0.31 plus or minus 0.01) K; TmOOH remained paramagnetic for the same temperature region (4.2 K to 0.04 K). These differences are attributed to competition between a strong crystal field and an anisotropic dipole exchange effect among Tm-ions.
Transl. by G.G.

N72-31749# Hamburg Univ. (West Germany).
THEROY OF PURE TYPE 2 SUPERCONDUCTORS WITH EMPHASIS ON ULTRASONIC ABSORPTION Ph.D. Thesis [THEORIE REINER TYP-2 SUPRALEITER MIT BESONDERER BERUECKSICHTIGUNG DER ULTRASCHALLABSORPTION]
Kurt Scharnberg 1971 107 p refs In GERMAN
Avail: NTIS HC $7.50

The algebraic transformation of Gorkov equations allows approximative solutions for conductivity and ultrasonic absorption in type 2 superconductors exposed to strong magnetic fields. The effects of ultrasonic absorption in metal electrons at low temperatures are described by a system of conduction electrons and their kinetic energies in crystal lattice frequencies.
Transl. by G.G.

N72-31750# Compagnie Francaise Thomson-Houston, Bagneux (France).
STUDY OF CORRELATION BETWEEN STRUCTURE DEFECTS AND PERFORMANCE OF SEMICONDUCTOR DEVICES Final Report [ETUDE DE LA CORRELATION ENTRE LES DEFAUTS DE STRUCTURE ET LES PERFORMANCES DES DISPOSITIFS A SEMI-CONDUCTEURS RAPPORT FINAL]
M. Arnaud and G. Blet [1971] 52 p refs In FRENCH
(Contract DGRST-69-01-919-00-212-75-01)
Avail: NTIS HC $4.75

An X-ray reflection method has been used to study the (440) and (533) planes of silicon diodes in order to investigate the surface topography of silicon semiconductors. Crystal defects in substrates were localized and identified and their evolution was observed. These defects were then correlated to the electric performance of semiconductor devices. Oxide constraints and imperfections due to diffusion phenomena were observed, but there was not any noticeable modification of electrical properties of diodes. It is concluded that topography and topometry will in the future, be applied to the characterization of MOS transistors.
ESRO

N72-31751# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
MATERIALS INVESTIGATIONS OF GALLIUM ARSENIDE USING SCHOTTKY DIODES [MATERIALUNTERSUCHUNGEN AN GALLIUMARSENID MIT SCHOTTKY-DIODEN]
K. Heime Feb. 1971 31 p refs In GERMAN
(FTZ-A-16-TBr-1) Avail: NTIS HC $3.75

A method is presented to determine doping and doping profiles of epitaxial gallium arsenide layers in liquid phase. The principle of Schottky diodes (metal semiconductor constants) is used to determine the doping of the semiconductor material beneath a metal contact. Measurements were carried out with deposited contacts and with a sliding contact. A partly automated method is described. It is shown that this method enables all types of Ga as material to be investigated. Together with Hall measurements, capacitance measurements give an exact impression of the amount of doping, as well as doping variations within the layers.
ESRO

N72-31752# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF SLIDING FRICTION MODES ON EXOELECTRON EMISSION PARAMETERS
L. G. Korshunov 3 Apr. 1972 10 p refs Transl. into ENGLISH from Tr. Ural'sk. Politekhn. Inst. (Sverdlovsk), no. 177, 1966 p 53-57
(AF Proj. 7343)
(AD-743140; FTD-HC-23-1844-71) Avail: NTIS CSCL 20/12

Thermally stimulated electron emission of 40Kh10G10 steel samples subjected to sliding friction at different sliding velocities Nu was studied in a vacuum using a secondary electron multiplier. Also measured were the magnitude of induced wear, intermediate contact electrical resistance, the coefficient of friction, and the emf occurring under friction. As Nu increases from 0.75 to 4.5 m/sec, two maxima appear on the thermally stimulated electron emission curves in the regions 170 and 270 C. A more intense thermally stimulated electron emission is observed after sliding with V equals 4.5 m/sec, and this also produces greater wear.
Author (GRA)

N72-31753# Naval Ordnance Lab., White Oak, Md.
AMORPHOUS FILM Pb-Sn-Ge-Te DETECTORS FOR INFRARED APPLICATIONS Final Report, 31 Mar. 1971 - 31 Mar. 1972
R. G. Morris 4 May 1972 59 p refs
(AD-742809; NOL-PO-1-0166) Avail: NTIS CSCL 20/12

Amorphous films of Pb-Sn-Ge-Te have been made and analyzed in terms of their infrared photoconductive response. A detailed analysis of the temperature and light intensity dependencies has led to a model for the recombination kinetics of photoexcited carriers.
Author (GRA)

N72-31754# Michigan Univ., Ann Arbor. Electron Physics Lab.
SOLID-STATE PLASMA ELECTROKINETIC POWER AND ENERGY RELATIONS
J. J. Soltis Mar. 1972 299 p refs
(Contract F30602-71-C-0099; AF Proj. 5573)
(AD-743200; TR-123; RADC-TR-72-54) Avail: NTIS CSCL 20/12

A general theory is developed for the electrokinetic power and energy properties associated with the basic carrier modes present in plasma media. Both hydrodynamic and kinetic theoretical models are obtained for the media in the presence of applied static electric and magnetic fields. In the hydrodynamic theory the effects of carrier collisions and thermal diffusion are properly accounted for and explained by developing a second-order quasi-linear analysis. The quasi-linear theory, as a by-product, allows the analysis of the second-order Hall effect and related phenomena in solids.
Author (GRA)

N72-31755# State Univ. of New York at Albany.
STUDIES OF RADIATION DAMAGE IN SEMICONDUCTORS Annual Report, 1 May 1971 - 30 Apr. 1972
James W. Corbett 30 Apr. 1972 22 p refs
(Contract N00014-70-C-0296)
(AD-743134) Avail: NTIS CSCL 20/12

The program on the study of radiation damage in semiconductors is described. This work divides into three areas: (1) EPR measurements on silicon and diamond; (2) optical and electrical measurements on silicon and diamond; and (3) theoretical work on these materials and their defect structures, including the nature of the amorphous state. Author (GRA)

N72-31756# Dayton Univ. Research Inst., Ohio.
THE HUGONIOT OF A SOLID DETERMINED BY MEANS OF A VARIATIONAL PRINCIPLE
James F. Heyda Wright-Patterson AFB, Ohio AFML Dec. 1971 28 p refs
(Contract F33615-70-C-1228; AF Proj. 7360)
(AD-743027; AFML-TR-71-259) Avail: NTIS CSCL 20/12

The formulation of the Gruneisen coefficient based on the velocity doubling approximation is used to define a normalized Gruneisen coefficient. A new integral formulation for the free surface velocity is then written in terms of this normalized coefficient. On the assumption that the specific energy of the solid at 0K is a known function of the specific volume and that the bulk sound speed in the uncompressed state is a known quantity, the Hugoniot of the solid is chosen to be that curve, among a family of curves lying on a Mie-Gruneisen constraint surface, which maximizes the free surface velocity. A differential equation for the resulting Hugoniot is determined and its solution is approximated by the first three terms of a series expansion. This expansion furnishes a quadratic expression for the shock velocity in terms of the particle velocity all of whose coefficients are given by formulas involving physically meaningful quantities. Calculations have been made in the case of aluminum and have been found to agree with the experimental data out to 340 kb very closely. A preliminary check for sodium metal is also given. Author (GRA)

N72-31757# Picatinny Arsenal, Dover, N.J.
A SURVEY OF THE PHYSICS OF SHOCK WAVES IN SOLIDS
Paul Harris Feb. 1972 42 p refs
(AD-742666; PA-TR-4345) Avail: NTIS CSCL 20/12

The concept of shock wave physics in solids is generalized to include thermal (second sound) shocks, electromagnetic shocks, as well as the more generally understood mass density shocks. It is speculated that thermal shocks may be made to occur in room temperature metals by causing a high power pulsed laser to impact on the metal surface. A laser pulse width of 10 to the minus 12th power seconds is derived for the effect to occur. The state-of-the-art with respect to understanding the compaction behavior of porous materials, the microscopic explanation of electromechanical effects (shock polarization) in a variety of media, and the state of our understanding of the physics of the detonation process is discussed. Author (GRA)

N72-31758# Energy Conversion Devices, Inc., Troy, Mich.
RESEARCH ON THE PROPERTIES OF AMORPHOUS SEMICONDUCTORS AT HIGH TEMPERATURES Semiannual Technical Report, 18 May - 18 Dec. 1971
John P. Deneufville 18 Dec. 1971 109 p refs
(Contract DAHC15-70-C-0187; ARPA Order 1570)
(AD-742833; ECD-516-3; SATR-3) Avail: NTIS CSCL 20/12

The report is a survey of thermodynamic, structural, optical and electrical transport properties in prototypical glassy chalcogenide systems. Research is centered on the Ge-Te system, sputtered amorphous GeTe2 - (GeSe2 Alloys new transport measurements and proposed band model), and survey studies of high T(g) ternary and pseudo - ternary chalcogenide systems. GRA

N72-31759# Pennsylvania State Univ., University Park. Materials Research Lab.
RESEARCH ON CONTACTS BETWEEN CHALCOGENIDE GLASSES, METALS AND SEMICONDUCTORS Semiannual Report
H. K. Henisch 1 Jun. 1972 60 p refs
(Contract DAHC04-70-C-0047; ARPA Order 1562)
(AD-742822) Avail: NTIS CSCL 20/12

Contents: Pre-threshold conductance and polarization effects in amorphous semiconductor switches; Thermal and non-thermal processes in threshold switching; Behavior of amorphous semiconductor films between asymmetric electrodes; Relaxation processes in Chalcogenide glass threshold switches. GRA

N72-31760# Army Foreign Science and Technology Center, Charlottesville, Va.
SOME ELECTRICAL AND THERMAL ELECTRICAL PROPERTIES OF GaAs - CdS SOLID SOLUTIONS
A. V. Voitsekhovskii and A. D. Pashun 14 Jan. 1972 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 5 (96), 1970 p 153-155
(AD-742894; FSTC-HT-23-1583-71) Avail: NTIS CSCL 20/12

Electrical conductivity, Hall constant and differential thermal emf are measured on n type GaAs CdS samples. Both temperature dependencies and dependencies on CdS percentage are developed. Author (GRA)

N72-31761# Texas Univ., Austin.
AMORPHOUS SEMICONDUCTORS Semiannual Technical Report, 1 Oct. 1971 - 31 Mar. 1972
James C. Thompson 31 Mar. 1972 20 p refs
(Contract DA-ARO(D)31-124-71-G102; ARPA Order 1562)
(AD-742491; AROD-9687-3) Avail: NTIS CSCL 20/12

Data have been taken on sound speed in Ge, Te, As alloys as a function of pressure and of temperature. Such data reveals the mechanical properties of the semiconducting glasses to be quite similar to those of conventional glasses. Measurement of pressure effects on dc resistivity confirm the earlier results of Fagen, et al. AC experiments are incomplete at present. Correlations between the glass transition T(g) and electrical activation reported by Krebs are used to predict the trend of T(g) with pressure. Author (GRA)

N72-31762# Army Foreign Science and Technology Center, Charlottesville, Va.
ELECTRONICS STRUCTURE AND THERMOELECTRIC PROPERTIES OF TRANSITION METAL COMPOUNDS
Yu. M. Goryachev, T. G. Kutsenok, and L. I. Zadvornyi 2 May 1972 11 p refs Transl. into ENGLISH from the mono. "Khimicheskaya Svyaz v Poluprovodnikakh" Minsk, 1969
(AD-742511; FSTC-HT-23-216-72) Avail: NTIS CSCL 20/12

Relationship between thermoelectric properties and electron structure of transition element compounds is considered. It is concluded that thermoelectric properties of transition element compounds can be explained only by allowing for the multi-band status of electron zones. First-approximation information can be obtained from theoretical group analysis of symmetry of the nearest neighborhood of atoms. Author (GRA)

N72-31763# Paris Univ. (France).
OPTICAL INVESTIGATION OF THE ELECTRONIC STRUCTURE OF BINARY ALLOYS: NOBLE METAL-NOBLE METAL ALLOYS Final Technical Report, Jan. - Dec. 1971
F. Abeles, J. Rivory, and M. L. Theye Feb. 1972 34 p refs
(Contract DAJA37-71-C-2638; DA Proj. 200-61102-B-11B)
(AD-742852; ARDG(E)-E-1484) Avail: NTIS CSCL 20/12

The report summarizes the results of optical investigations obtained on a series of Au-Cu alloy films. Emphasis is given to problems relating to the preparation and characterization of these films in disordered and ordered phases. In particular, the importance of heat treatments by simultaneous resistance measurements and of adjusting both the temperature and

kinetics of annealing and quenching cycles is demonstrated. Interpretation of the observed optical properties of the disordered alloys is given according to recently proposed theories based on a coherent potential approximation. Finally, property changes are related to phase transformatoins. Author (GRA)

N72-31764# University of Southern Calif., Los Angeles. Electronics Sciences Lab.
RADIATIVE RECOMBINATION IN SEMICONDUCTORS Final Report, 15 Sep. 1968 - 14 Sep. 1971
M. Gershenzon 1972 18 p refs
(Contracts DA-ARO(D)-31-124-70-G15; DA-ARO(D)-31-124-G1054; DA Proj. 200-61102-B-31E) (AD-742729; AROD-7403-1-E) Avail: NTIS CSCL 20/12

Heavily doped n-type single crystals of GaN were grown epitaxially by the vapor phase reaction of GaCl and NH3 on Sapphire substrates. GaN is a direct gap semiconductor with a bandgap of 3.25 eV. It fluoresces efficiently in the visible as well as the UV. Single crystals of AlP were prepared by the disproportionation of gaseous AlI in the presence of PH3 either as freely nucleated whiskers or epitaxially on GaAs or Si substrates. Attempts to determine the mechanisms of the efficient Cu green luminescence in ZnS and the mechanism responsible for room temperature lasing in CdS were unsuccessful. In order to design semiconductor alloy systems to achieve high efficiency luminescence in the visible, the authors have observed the effects of alloying small amounts of InP and AlP with GaP on the luminescence of GaP. Author (GRA)

N72-31765# Illinois Inst. of Tech., Chicago. Dept. of Physics.
QUANTITATIVE MEASUREMENT OF THE PROPERTIES OF DEFECTS IN METALS Final Report, 22 Sep. 1964 - 30 Sep. 1971
Paul Gordon and Allan J. Frederick 1971 5 p refs
(Contract DA-ARO(D)-31-124-G597; DA Proj. 200-61102-B-32D)
(AD-742726; AROD-5030-3-MC) Avail: NTIS CSCL 20/2

In the study of defect interactions in solids the field ion microscope has become an important tool. Until now, the interpretation of field ion microscope patterns has been done primarily on the geometric relationship of the spots. A technique and an equation by which additional information can be obtained from field ion patterns, specifically with regard to the quantity of the electric field at an imaging spot, is now available as a result of the present research. By calculation of the electric field at a selected spot, quantitative field ion information can be directly employed in the study of strengthening mechanisms of materials. For example, the identity of the interstitial bright spot can be deduced if the value of the electric field is known when the spot field evaporates. Author (GRA)

N72-31766# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METALLOGRAPHIC STUDY OF THE SUBSTRUCTURE OF RUTHENIUM SINGLE CRYSTALS
E. M. Savitskii, V. P. Polyakova, and N. B. Gorina 22 Feb. 1972 10 p refs Transl. into ENGLISH from the Publ. "Monotkristally Tugoplavkikh i Redkikh Metallov" USSR, 1969 p 65-69
(AD-742688; FTD-HC-23-1998-71) Avail: NTIS CSCL 20/2

Rhenium, osmium, and iridium single crystals were obtained by zone melting. Polishing and etching methods of ruthenium single crystals are described. Under analogous experimental conditions of crystal growth, ruthenium single crystals can have a different structure, which depends on crystallographic orientation. Author (GRA)

N72-31972* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL NOISE IN SPACE-CHARGE-LIMITED HOLE CURRENT IN SILICON
A. Shumka, J. Golder, and M.-A. Nicolet *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 72-76 refs (For availability see N72-31964 22-34)
CSCL 20L

N72-31974* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUPERCONDUCTIVITY IN THE ALKALI METAL INTERCALATES OF MOLYBDENUM DISULPHIDE
R. B. Somoano, V. Hadek, and A. Rembaum *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 83-89 refs (For availability see N72-31964 22-34)
CSCL 20L

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-31767*# National Aeronautics and Space Administration, Washington, D.C.
SOLID PROPELLANT PROCESSING FACTOR IN ROCKET MOTOR DESIGN Space Vehicle Design Criteria (Chemical Propulsion)
Oct. 1971 82 p refs
(NASA-SP-8075) Avail: NTIS HC $3.00 CSCL 21I

The ways are described by which propellant processing is affected by choices made in designing rocket engines. Tradeoff studies, design proof or scaleup studies, and special design features are presented that are required to obtain high product quality, and optimum processing costs. Processing is considered to include the operational steps involved with the lining and preparation of the motor case for the grain; the procurement of propellant raw materials; and propellant mixing, casting or extrusion, curing, machining, and finishing. The design criteria, recommended practices, and propellant formulations are included. F.O.S.

N72-31768# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
EMISSION CHARACTERISTICS OF PROPANE AS AUTOMOTIVE FUEL
J. R. Allsup and R. D. Fleming [1972] 38 p refs
(BM-RI-7672; TN23.U7) Avail: NTIS HC $4.00

Air pollutants in exhaust gas produced from LP-gas (propane) were studied using both laboratory engines and vehicles. The objective was to evaluate engine parameters relating to the advantageous use of propane as a low-pollution fuel. Some comparisons are made between gasoline, natural gas, and propane. Results show that engines can operate over a wider range of A/F with minimum carbon monoxide and hydrocarbon emission when using propane than when using gasoline. Mixture enrichment using propane is unnecessary during cold starts, thereby eliminating the emission penalty during warmup. Carbon monoxide and hydrocarbon emission using propane are unaffected by ambient temperature. The photochemical reactivity of hydrocarbon emission is considerably lower with propane than with gasoline. Author

N72-31769# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
EXPANDED COMPUTER PROGRAM FOR THE PERFORMANCE CALCULATION OF ROCKET PROPELLANTS AND PROPELLENT CHARGE POWDERS [ERWEITERTES RECHENPROGRAMM ZUR LEISTUNGSBERECHNUNG VON RAKETENTREIBSTROFFEN UND TREIBLADUNG-SPULVERN]
F. Volk and H. Bathelt 31 Dec. 1971 117 p refs In GERMAN
(ICT-5/71) Avail: NTIS HC $8.00

A FORTRAN 4 computer program suitable for time sharing operation, and for the calculation of propellant performance is presented. The nozzle geometry is calculated for several expansion ratios. ESRO

N72-31770# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
GENERAL COMPUTER PROGRAM FOR THE EQUILIBRIUM AND PERFORMANCE CALCULATION OF GASEOUS COMPOUNDS [ALLGEMEINES RECHENPROGRAMM ZUR GLEICHGEWICHTS- UND LEISTUNGSBERECHNUNG GASFOERMIGER VERBINDUNGEN]
F. Volk and H. Bathelt 15 Jan. 1972 45 p refs In GERMAN
(ICT-1/72) Avail: NTIS HC $4.25

A computer program is described that can be used for performance calculation of gaseous compounds as well as for the determination of the equilibrium composition of propellents used for liquid ramjet rocket engines. The program written in FORTRAN 4, can also be used to determine the dissociated gas composition for pyrolysis of hydrocarbons. The program contains thermodynamic data for C-, H-, O-, and N-containing components, and can be extended to further gaseous compounds. Advantages are obtained by the use of mole fractions rather than mole numbers and logarithmic transformation, of which the most important is that no negative mole numbers occur. Therefore iteration difficulties can be cleared. ESRO

N72-31771# Naval Postgraduate School, Monterey, Calif.
AN OPTICAL STUDY OF AMMONIUM PERCHLORATE SANDWICHES WITH A POLYBUTADIENE ACRYLIC ACID BINDER M.S. Thesis
John Richard Kennedy Dec. 1971 56 p refs
(AD-742939) Avail: NTIS CSCL 21/9

Ammonium perchlorate/polybutadiene acrylic acid propellant sandwiches were burned in a nitrogen purge atmosphere at various pressures in a combustion bomb designed for optical and rapid depressurization studies. A Hycam camera was utilized for taking high speed color schlieren and regular photographs to obtain information about the flame structure during combustion. The effects of pressure on flame structure are discussed.
Author (GRA)

N72-31772# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF PREFERENTIAL INTERFACIAL REACTIONS IN NONMETALIZED COMPOSITE SOLID PROPELLANT COMBUSTION M.S. Thesis
George Monroe Biery, II Mar. 1972 40 p refs
(AD-742936) Avail: NTIS CSCL 21/9

Four nonmetalized solid propellants were burned at 500 psi in strands of 1/2 in. by 1/2 in. cross section and 2 in. length in both a dewetted and an as-cast state. Strands were burned at acceleration levels from zero to 1000g normal and into the burning surface, and 50g and 1000g normal and out of the burning surface. The effects of changing interfacial characteristics of the oxidizers and binder by prestressing (dewetting) were studied to determine if preferential interfacial reactions between binder and oxidizer particles provided an accurate explanation of burning rate augmentation. Author (GRA)

N72-31773# Naval Postgraduate School, Monterey, Calif.
CINEMATOGRAPHIC STUDY OF AP/PBAA SANDWICH BURNERS IN A POSITIVE ACCELERATION FIELD M.S. Thesis
Wendell Earl Brown Mar. 1972 40 p refs
(AD-742927) Avail: NTIS CSCL 21/9

Ammonium perchlorate/polybutadiene-acrylic acid (AP/PBAA) sandwich burners were burned in a combustion bomb. These were formed by bonding two polycrystalline AP wafers together with PBAA. Pressures were varied from 200 to 800 psig. Acceleration was either standard gravity or -100 g, i.e., 100 g directed normal and into the burning surface. Sandwich burns were recorded using high speed color motion pictures. It was found that binder/AP interactions cause transient burning rates which are sensitive to acceleration. Author (GRA)

N72-31774# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
CHEMICAL STRUCTURAL AGING EFFECTS Special Interim Technical Report
Lionel H. Layton Edwards AFB, Calif. AFFTC May 1972 34 p
(Contract F04611-71-C-0049)
(AD-743225; Rept-0472-36813; AFRPL-TR-72-49) Avail: NTIS CSCL 21/9

During the past ten years of solid propellant development, the problem of predicting motor service life from propellant viscoelastic behavior and accelerated aging data has persisted. The basic theory for converting elevated temperature aging results to long term equivalent ambient aging predictions depends upon either a single chemical reaction or competing reactions having the same reaction rates and activation energies. Each chemical reaction occurring during cure and aging of the solid propellant contributes by either increasing or decreasing the tensile strength of the material. While it is not possible to control the chemical reactions in such a fashion that its contribution to the material mechanical properties can be determined, a procedure is presented to determine these individual reaction effects using a mathematical correlation of the chemical reaction rate and mechanical properties data. A sample computation is presented using limited data available.
Author (GRA)

N72-31973* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LONG-TERM STORAGE TEST OF A SYNCOM SOLID ROCKET MOTOR
R. L. Ray *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 77-82 ref (For availability see N72-31964 22-34)
CSCL 21I

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-31775# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
FACILITY STUDIES OF PROPULSION SYSTEMS FOR VELOCITIES ON THE ORDER OF 8 km/sec WITH LOADS TO 50 kgs, AND ROCKET CONTROL AND GUIDANCE SYSTEMS, VOLUME 1 [ESTUDIO DE FACTIBILIDAD SOBRE SISTEMA DE PROPULSION PARA ALCANZAR VELOCIDADES DEL ORDEN DE 8 KM/SEC CON CARGAS UTILES DE 50 KGS Y SOBRE SISTEMAS DE CONTROL Y GUIADO PARA COHETES, TOMO 1]
C. A. Cavallino and O. Delsoldato 1971 22 p In SPANISH
Avail: NTIS HC $3.25

Simplified equations of motion are used to calculate the dimensions of a rocket propulsion system capable of velocities of 8 km/sec with payloads of 50 kgs. The optimum mass of the rocket for the propulsion system is computed. Transl. by F.O.S.

N72-31776# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
FACILITY STUDIES OF PROPULSION SYSTEMS FOR VELOCITIES ON THE ORDER OF 8 km/sec WITH LOADS OF 50 kgs, AND ROCKET CONTROL AND GUIDANCE SYSTEMS, VOLUME 2 [ESTUDIO DE FACTIBILIDAD SOBRE SISTEMA DE PROPULSION PARA ALCANZAR VELOCIDADES DEL ORDEN DE 8 KM/SEG CON CARGAS UTILES DE 50 KGS Y SOBRE SISTEMAS DE CONTROL Y GUIADO PARA COHETES, TOMO 2]
C. A. Cavallino and O. DelSoldato 1971 34 p refs In SPANISH
(Rept-13) Avail: NTIS HC $3.75

A preliminary study of a system for controlling rockets

during combustions was studied in large rockets with low acceleration. A control system utilizing auxiliary engines for rocket orientation is analyzed. It is concluded that a free gyroscope with sensors in three dimensions, and four servomotors are required for actuating four auxiliary rocket engines.
Transl. by F.O.S.

N72-31777*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS AFFECTING ALTITUDE RELIGHT PERFORMANCE OF A DOUBLE-ANNULAR RAM-INDUCTION COMBUSTOR
Donald F. Schultz and Edward J. Mularz Washington Sep. 1972 28 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland, Ohio
(NASA-TM-X-2630; E-6788) Avail: NTIS HC $3.00 CSCL 21H

A test program was conducted to evaluate the altitude relight capabilities of a short-length, double-annular, ram-induction combustor which was designed for Mach 3 cruise operation. The use of distorted inlet-air flow profiles was tried to evaluate their effect on the relight performance. No significant improvement in altitude relight performance was obtained with this approach. A study was also made to determine the effects of the reference Mach number, the fuel temperature, and the fuel volatility (ASTM-A1 against JP-4) on the altitude relight performance. Decreasing the reference Mach number, increasing the fuel temperature, and using more volatile fuel all decrease the combustor pressure necessary for relight. Author

N72-31778*# Aerojet Liquid Rocket Co., Sacramento, Calif.
A GRAPHITE-LINED REGENERATIVELY COOLED THRUST CHAMBER
V. R. Stubbs [1972] 261 p
(Contract NAS3-13315)
(NASA-CR-120853) Avail: NTIS HC $15.25 CSCL 21H

Design concepts, based on use of graphite as a thermal barrier for regeneratively cooled FLOX-methane thrust chambers, have been screened and concepts selected for detailed thermodynamic, stress, and fabrication analyses. A single design employing AGCarb-101, a fibrous graphite composite material, for a thermal barrier liner and an electroformed nickel structure with integral coolant passages was selected for fabrication and testing. The fabrication processes and the test results are described and illustrated. Author

N72-31779*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF ADVANCED PROPULSION CONCEPTS FOR DEEP SPACE EXPLORATION
W. E. Moeckel Washington Sep. 1972 37 p refs
(NASA-TN-D-6968; E-6798) Avail: NTIS HC $3.00 CSCL 21C

Equations and charts are presented that permit rapid estimation of propulsion-system performance requirements for some typical deep-space missions. A number of advanced propulsion concepts for which performance estimates are available are compared with respect to their capability for flyby, rendezvous, and roundtrip planetary missions. Based on these estimates, the gas-core nuclear fission rocket and the pulsed fusion rocket yield the fastest trip times to the near planets. For round trips to Jupiter and beyond, the controlled fusion rocket shows progressively superior capabilities. Several propulsion concepts based on use of impinging laser beams are found to be noncompetitive with the other advanced concepts for deep space missions. Requirements for attainment of interstellar distances within a human lifetime are found to be some orders of magnitude beyond the capabilities of any propulsion concepts for which performance estimates are now possible. Author

N72-31780*# Avco Corp., Lowell, Mass. Systems Div.
HIGH TEMPERATURE COMPOUNDS FOR TURBINE VANES
W. H. Rhodes and R. M. Cannon, Jr. Sep. 1972 70 p refs
(Contract NAS3-14333)
(NASA-CR-120966; AVSD-0336-72-CR) Avail: NTIS HC $5.50 CSCL 21E

Fabrication and microstructure control studies were conducted on SiC, Si3N4, and composites based on these compounds. Charpy mode impact testing to 2400 F established that beta-spodumene, lithium aluminum silicate, coated Si3N4, Si3N4 derived from alpha-Si3N4 powder, and SiC containing 5-25 v/o chopped C fibers had the most promising strengths. Several other composite systems had excellent microstructures and could prove interesting materials in the future. Stress-rupture testing on Si3N4 established that increasing 2000 F - 100 hour strengths were obtained for increasing grain size to at least 5 micrometers, increasing density and possibly increasing phase purity. These parameters became less important at 2400 F where it is thought a grain boundary phase controls strength.
Author

N72-31781# Smithsonian Institution, Washington, D.C. Air and Space Museum.
THE CURTISS D-12 AERO ENGINE Annals of Flight, No. 7
Hugo T. Byttebier 1972 115 p refs
Avail: SOD $0.75

The history of the Curtis D-12 aircraft engine is presented. The design, engineering, and manufacturing of various types of the D-12 engine are discussed. The application of the engine in a series of aircraft is described. Line drawings, illustrations, and photographs are included to clarify text. P.N.F.

N72-31782*# Fairchild Industries, Inc., Farmingdale, N.Y. Republic Div.
TASK 2: FLIGHT PROTOTYPE SYSTEM DESIGN REPORT, PULSED PLASMA SOLID PROPELLANT MICROTHRUSTER FOR THE SYNCHRONOUS METEOROLOGICAL SATELLITE Interim Report, Nov. 1971 - Apr. 1972
William J. Guman, ed. Apr. 1972 157 p refs
(Contract NAS5-11494)
(NASA-CR-122478; FRD-4082) Avail: NTIS HC $10.00 CSCL 21C

Design details are presented of the solid propellant pulsed plasma microthruster which was analyzed during the Task 1 effort. The design details presented show that the inherent functional simplicity underlying the flight proven LES-6 design can be maintained in the SMS systems design even with minimum weight constraints imposed. A 1293 hour uninterrupted vacuum test with the engineering thermal model, simulating an 18.8 to 33 g environment of the propellant, its feed system and electrode assembly, revealed that program thruster performance requirements could be met. This latter g environment is a more severe environment than will be ever encountered in the SMS spacecraft. Author

N72-31783*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD-AIR INVESTIGATION OF A TURBINE FOR HIGH-TEMPERATURE-ENGINE APPLICATION. 4: TWO-STAGE TURBINE PERFORMANCE
Warren J. Whitney, Harold J. Schum, and Frank P. Behning Washington Sep. 1972 27 p refs
(NASA-TN-D-6960; E-6912) Avail: NTIS HC $3.00 CSCL 21E

The efficiency of a two-stage turbine is discussed. The turbine efficiency was 0.932 for equivalent design operating conditions (speed) and specific work, which compares closely to the value of 0.929 that would be estimated using the first-stage efficiency. The mass flow obtained with the two-stage configuration indicated that the mass flow characteristics of the two stages were closely matched at design operating conditions. The stage work split at these conditions was 0.505-0.495, which was close to the design work split of 0.515-0.485.
Author

N72-31784*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL DYNAMIC RESPONSE OF A TWO-DIMENSIONAL, MACH 2.7, MIXED COMPRESSION INLET
Robert J. Baumbick, George H. Neiner, and Gary L. Cole Washington Sep. 1972 31 p refs
(NASA-TN-D-6957; E-7002) Avail: NTIS HC $3.00 CSCL 21A

A test program was conducted on a two-dimensional supersonic inlet. Internal disturbances in diffuser exit mass flow were produced by oscillating overboard bypass doors. Open-loop dynamic responses of shock position, throat exit and diffuser exit static pressures are presented. The steady-state and dynamic coupling between ducts were also obtained. The experimental results from the two-dimensional inlet are compared to results from a similar size axisymmetric inlet and also to a transfer function synthesis program. Author

N72-31785*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT INVESTIGATION OF AN AIR-COOLED PLUG NOZZLE WITH AFTERBURNING TURBOJET
Nick E. Samanich Washington Sep. 1972 56 p refs
(NASA-TM-X-2607; E-6676) Avail: NTIS HC $3.00 CSCL 21E

A convectively cooled plug nozzle, using 4 percent of the engine air as the coolant, was tested in 1967 K (3540 R) temperature exhaust gas. No significant differences in cooling characteristics existed between flight and static results. At flight speeds above Mach 1.1, nozzle performance was improved by extending the outer shroud. Increasing engine power improved nozzle efficiency considerably more at Mach 1.2 than at 0.9. The effect of nozzle pressure ratio and secondary weight flow on nozzle performance are also presented. Author

N72-31786# General American Transportation Corp., Niles, Ill. Research Div.
EDDY CURRENT INSPECTION OF TURBINE BLADES Technical Report, Aug. 1969 - Mar. 1971
I. R. Kraska and H. W. Kamm Wright-Patterson AFB. Ohio AFML Oct. 1971 41 p
(Contract F33615-68-C-1429; AF Proj. 7351)
(AD-743105; AFML-TR-70-266) Avail: NTIS CSCL 21/5

The report presents the results of a program to find a nondestructive field inspection technique which will detect cracks in the leading and trailing edges of jet engine turbine blades. Such an inspection is required because the presence of cracks causes blade failures and can cause the loss of an engine or entire aircraft. Various nondestructive inspection methods were considered and experimentally evaluated in the laboratory. One was found suitable for field testing. This method, which uses eddy currents, is described in detail. Field and lab test data are presented. They include response characteristics, speeds of inspection, and micrographs of typical cracks detected in the turbine blades of built up rotors from various engines. The system is capable of detecting cracks down to 0.020 in. in length, 0.0005 in. wide, and 0.005 in. deep. On built up rotors of an engine having 108 cleaned blades per stage cracks could be detected at an inspection rate of one stage in 15 minutes. The penetrant system could detect cracks at an inspection rate of one stage in 1 hour and 50 minutes. Author (GRA)

N72-31787# Naval Air Propulsion Test Center, Philadelphia, Pa. Aeronautical Engine Dept.
A TEST METHOD FOR NONDESTRUCTIVE TESTING OF FUEL FILTRATION EQUIPMENT USING THERMOGRAPHY
Anthony P. Pontello Dec. 1971 26 p refs
(AD-743081; NAPTC-AED-1963) Avail: NTIS CSCL 14/2

A method for nondestructive testing of fuel filters and other turbine parts has been developed using thermography. Thermography detects temperature differences on an object in the form of a thermal picture (thermogram) through use of the natural infrared radiation which varies with the surface temperature of the object. Thermal changes resulting from material defects are detected by the thermogram through the various colors displayed when the temperature differences are converted electronically to a color television picture. Experimental results also showed thermography to be successful as a nondestructive test device for determining defects in fuel handling equipment. Author (GRA)

N72-31788# Naval Postgraduate School, Monterey, Calif.
VIBRATIONAL AND CHEMICAL NONEQUILIBRIUM IN A STOICHIOMETRIC TURBOJET ENGINE USING KEROSINE-TYPE FUEL M.S. Thesis
Wiley Paul DeCarli Mar. 1972 74 p refs
(AD-742948) Avail: NTIS CSCL 21/5

The effects of vibrational and chemical nonequilibrium on turbine performance were investigated separately. The vibrational model was taken as a pure nitrogen expansion, and the chemical model was taken as the combustion products of a stoichiometric mixture of kerosene and air. The loss of performance of fully frozen flow with respect to the equilibrium flow for each model was determined. The extent to which nonequilibrium will occur was investigated within limited ranges of pressure and temperature. Vibrational nonequilibrium can result in losses up to seven percent with respect to equilibrium flow. Vibrational freezing will be virtually complete a short distance after the throat of the first stator assembly. The losses due to chemical nonequilibrium are insignificant compared to the vibrational nonequilibrium losses. Author (GRA)

N72-31789# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PROGRAM FOR THE EQUIVALENT TESTING OF GAS TURBINE ENGINES
N. D. Kuznetsov and V. I. Tseitlin 27 Mar. 1972 18 p Transl. into ENGLISH from Probl. Proch. Mashinostr. (Moscow), no. 10, 1970 p 14-19
(FTD Proj. G101)
(AD-743145; FTD-MT-24-2121-71) Avail: NTIS CSCL 21/5

Verifying the reliability of engines for prolonged service life by conducting protracted tests for a given service life does not assure rapid rates of growth of service life. To accelerate the rate of growth of service life and check on the capabilities of engines for prolonged service life it is necessary to conduct accelerated tests according to a program which will assure equivalence of the loading of units and parts for a given service life. In the report the basis for a program of accelerated equivalent tests of engines, compiled from analysis of the factors that exhaust the service life of units and parts is given. Author (GRA)

N72-31790# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A DISCUSSION AND COMPARISON OF JET ENGINE OVERHAUL COSTS M.S. Thesis
Charles I. Boyer 28 Jan. 1972 52 p refs
(AD-743417; SLSR-30-72A) Avail: NTIS CSCL 15/5

An attempt to compare the cost of overhauling a jet engine at alternative overhaul facilities must consider the various costing concepts and methods involved. Stated costs which are presented without a reference to included and excluded cost elements are often misleading and unrealistic. Major differences between a government facility and a private facility in regards to operating costs must be identified and included in any cost comparison. The report presents the basic costing methods pursued by two overhaul facilities and discusses the various cost effects which the two methods are likely to produce. A final cost comparison is presented after consideration of these effects. Author (GRA)

N72-31791# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN APPLICATION OF SPECTRAL ANALYSIS TO TF33-3 ENGINE REMOVAL DATA M.S. Thesis
William D. Arnold and James C. Wendt 28 Jan. 1972 120 p

refs
(AD-743401; SLSR-7-72A) Avail: NTIS CSCL 21/5

The thesis investigated two areas relative to removals of TF33-3 engines number of engine removals over time follow some kind of regular pattern. That is, is there cycling present in daily, weekly, monthly or quarterly engine removal data, and, if so, at what frequencies? The second area investigated was the relationship between program activities and TF33-3 engine removals. The program activities used were sorties, flying hours and engine operating hours. Relationships were examined at various time delays between the activities and the engine removals (up to 7-1/2 years). The mathematical tools used in analysis of the engine removal data were autocovariance, spectral analysis, and cross-covariance functions. Author (GRA)

N72-31792# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A STUDY OF FLYING HOURS AND SORTIES AS PREDICTORS OF B-52H ENGINE FAILURES M.S. Thesis
Charles L. Dow and Walter L. Schnee Jan. 1972 88 p refs
(AD-743400; SLSR-6-72A) Avail: NTIS CSCL 21/5

The report attempts to show that engine failures are dependent upon some combination of historical flying hour and sortie data. A method of arrangement was undertaken which transformed the collected data into specific historical groupings. These specific groups of data were then statistically analyzed and a forecasting model developed. The statistical analysis was performed by application of multiple correlation and regression techniques to the data. The Biomedical Series, BMDO2R, Stepwise Multiple Regression package was chosen for use. The predictive power of the model was evaluated, the statistical assumptions tested, research conclusions drawn, and recommendations made for further studies. Author (GRA)

N72-31793# Systems Research Labs., Inc., Dayton, Ohio.
PERFORMANCE EVALUATION OF THREE SUBSONIC ANNULAR DIFFUSERS
Charles N. Eastlake, II Apr. 1972 36 p refs
(Contract F33615-70-C-1515; AF Proj. 7116)
(AD-744058; ARL-72-0058) Avail: NTIS CSCL 21/5

An experimental investigation of the performance of three subsonic annular diffusers has been made. These diffusers have the same axial length (18-3/4 in.) and the same outlet-to-inlet area ratio (2.76) and the same outlet-to-inlet area ratio (2.76) and were tested at inlet velocities from approximately 100-450 feet per second. The basis on which their comparative performance was evaluated is static pressure recovery. The straight wall diffuser with a divergence angle of 12 degrees was found to be the best of the three available diffusers. The measured static pressure recovery coefficient of .6 is not particularly good, though conditions discussed in the report suggest in actual use the performance would be somewhat better. Author (GRA)

N72-31976* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR-ELECTRIC PROPULSION BREADBOARD THRUST SUBSYSTEM
T. D. Masek *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 100-112 refs (For availability see N72-31964 22-34) CSCL 21C

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-31794 Kodaikanal Observatory (India).
SUMMARY OF SOLAR OBSERVATIONS FOR THE FIRST HALF OF 1969
M. K. Vainu Bappu 1971 28 p
(PDGO-11-206-365; Ser-B-Bull-206) Copyright. Avail: Issuing Activity

The results of observation are presented for calcium prominences, calcium flocculi, and H alpha dark markings made at Kodaikanal Observatory during the first half of 1969. They are supplemented by data computed from photographs supplied by the Meudon Observatory for those days on which Kodaikanal had imperfect or no observations due to poor sky conditions. Author

N72-31795# National Physical Lab., New Delhi (India). Radio Science Div.
IONIZATION CONTRIBUTION BY COSMIC X RAY
A. P. Mitra and Y. V. Ramanamupty Dec. 1971 25 p refs
(Contract ESSA-E-2-68(N))
(RSD-71; PL-480-14) Avail: NTIS HC $3.50

The contribution of cosmic X-rays in the production of ionization in the nighttime D region is discussed in the light of observed X-ray flux emissions from the various celestial X-ray sources and from the galactic background. The cumulative effect of several sources, when they are in transit at close time intervals, can amount to a sizeable fraction of all nighttime sources which consist principally of scattered Ly-alpha and Ly-beta. Above 95 Km, the Ly-beta contribution is generally far in excess of the production due to cosmic X-rays. Exact contributions are difficult to establish, but a marginal ionospheric effect around 90 Km levels from cosmic X-ray sources seems possible at low latitudes. Author

N72-31796# Potchefstroom Univ. for Christian Higher Education (South Africa). Dept. of Physics.
COSMIC RAY NEUTRON MONITOR DATA, SANAE, ANTARCTICA, JANUARY - DECEMBER 1970
May 1972 50 p
(S.5) Avail: NTIS HC $4.50

Cosmic ray neutron monitor data of Sanae, Antarctica are presented in tabular form. Pressure corrected counts, uncorrected counts, atmospheric pressure, and monthly graphs and Sanae/Deep River ratios are included. J.A.M.

N72-31797# Royal Inst. of Tech., Stockholm (Sweden).
WEAKLY-SHOCKED FLOWS OF THE SOLAR WIND PLASMA THROUGH ATMOSPHERES OF COMETS AND PLANETS
Max Wallis Jan. 1972 26 p refs
(TRITA-EPP-72-2) Avail: AEC Depository Libraries

The quasi-one-dimensional, continuum description of the solar wind's ionizing interaction with neutral atmospheres is employed to give solutions to the upstream, transsonic flow. The subsonic flow is approximated by assuming constant total energy flux. Shocked solutions are found to mass-accreting flows, which pass suitably continuously over to shock-free solutions for low gradients in the ionization rate. Cometary shocks are subcritically weak, so they heat the electrons. They occur inside the ionization region, disturbing the solar wind over the mass-accretion scale length: this directly contradicts the earlier computed solutions, (Biermann et al. 1967), which are judged to be faulty. The shock ahead of Venus can also be subcritical if the relevant density gradient is provided by a suprathermal atmospheric component or if charge-exchange interactions effect rapid cooling of the plasma. Author (NSA)

N72-31798# Lockheed Missiles and Space Co., Palo Alto, Calif.
FORECAST OF THE UPPER ATMOSPHERE DENSITY DURING ARTIFICIAL EARTH SATELLITE LIFETIME
V. F. Kameko, V. M. Kovtunenko, E. P. Iaskevich, Iu. T. Reznichenko, and V. P. Albokha 1972 5 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 10, no. 3, 1972 p 450-453
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is described for forecasting the upper atmospheric density so that the optimal orbit of a low-flying satellite may be selected. One of the main factors affecting the density is the solar activity level, characterized by the index of the solar radio radiation density at the 10.7 cm wavelength, F(10.7). Therefore, emphasis is on the forecasting of the mean annual, mean monthly, and mean daily values of F(10.7). The mean annual magnitudes of the solar activity index are determined on the basis of the mean values of F(10.7) and its errors for each year of the preceding 11 years and then extrapolating. The long range mean monthly and diurnal values are forecast by harmonic analysis of the diurnal values of F(10.7) in a 1-year interval during the preceding 11 years. For short-term forecasts, recent measurements by satellites already in orbit are used.
N.E.N.

N72-31799# Clermont-Ferrand Univ. (France).
STUDY OF THE KNOCK-ON OF LIGHT NUCLIDES IN INTERACTIONS BETWEEN HIGH ENERGY PROTONS AND NUCLEI: COMPARISON WITH THEORETICAL MODELS, APPLICATIONS TO ASTROPHYSICS Ph.D. Thesis
Jean-Pierre Alard 1971 131 p refs In FRENCH; ENGLISH summary
(FRNC-TH-148) Avail: AEC Depository Libraries

After having reviewed the problems related to cosmic radiation, the propagation of cosmic rays in interstellar gas and the formation of singly or doubly charged light isotopes by fragmentation are discussed. Various theories enabling the ejection of light fast fragments (p,d,t,He-3, and He-4) to be explained are suggested: nuclear evaporation, pick-up reactions, direct knock-on reactions, and statistical theories. In particular, a thermodynamic interaction theory (p + nucleus) developed from the theory of Hagedorn is presented, this theory allowing the shape of the energy spectra and various production ratios between light nuclides to be predicted. Experiments were conducted in order to verify this theory: incident protons beams with energies of 20 GeV and 600 MeV were made to bombard A1, C, Fe, Ag, and Au targets. The following production ratios were determined: d/p, t/d, t/He-3, and He-3/He-4. NSA

N72-31800# Uppsala Univ. (Sweden). Cosmic Ray Group.
SOLAR MODULATION OF GALACTIC PARTICLES. NUMERICAL INTEGRATION OF THE STEADY FOKKER-PLANCK EQUATION
Nicolas J. Martinic 1972 60 p refs
(NP-19243) Avail: AEC Depository Libraries

Galactic protons and electrons are modulated by the solar atmosphere. From the numerical integration of the steady, spherically symmetric Fokker-Planck equation, which governs this phenomenon as a first approximation, it is shown that the galactic flux measured at the earth presents 3 effects; (1) convection, i.e., the sweeping-out of the galactic particles at the convective outward velocity of the solar wind, (2) creating a gradient of these particles; diffusion, i.e., the dynamical equilibrium between the gradient of galactic particles and the flux of particles, which tends to neutralize this gradient. The diffusion mechanism is defined by the diffusion coefficient together with the functional radial dependence. Finally (3) the adiabatic deceleration, i.e., the cooling-down effect of expansion of the bulk of galactic particles tied to the magnetic inhomogeneities frozen in the solar plasma. Author (NSA)

N72-31801# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
GEOMAGNETICALLY TRAPPED ALPHA PARTICLES. 1: OFF-EQUATOR PARTICLES IN THE OUTER ZONE
J. Bernard Blake and George A. Paulikas 20 May 1972 42 p refs
(Contract F04701-71-C-0172)
(AD-743293; TR-0172(2260-20)-19; SAMSO-TR-72-130) Avail: NTIS CSCL 04/1

The population of trapped alpha particles in five contiguous energy channels between 0.85 and 9.0 MeV was measured in the B, L intervals 2 < or = L < or = 4 and 0.60 < or = B < or = 0.35 gauss during June and July 1969. The particle distribution functions of these particles suggest that the location of the source of these particles is at L > 4 and that inward radial diffusion determines the spatial and energy distributions. The particle distribution functions show that these alpha particles do not diffuse into the inner zone. These results provide no support for the concepts of in-situ acceleration or direct capture of energetic solar alpha particles. Author (GRA)

N72-31802# Hulburt (E. O.) Center for Space Research, Washington, D.C.
OBSERVATIONS OF THE SOFT X RAY BACKGROUND
A. Davidsen, S. Shulman, F. Fritz, J. F. Meekins, R. C. Henry, and H. Friedman Apr. 1972 44 p refs
(AD-743267) Avail: NTIS CSCL 03/2

Observations of the diffuse X-ray background over a hemisphere of the sky in the galactic anticenter direction provide clear evidence for an excess intensity below 1 keV in all directions. The correlation of this low energy flux with galactic latitude and with hydrogen column density implies that the radiation originates partially within and partially outside the absorbing layers of the Galaxy. Author (GRA)

N72-31803# Aerospace Corp., El Segundo, Calif.
OBSERVATIONS OF THE SOLAR OSCILLATORY COMPONENT AT A WAVELENGTH OF 3 mm Technical Report, Sep. 1969 - May 1970
Fred I. Shimabukuro and Michal Simon (New York State Univ.) 17 Apr. 1972 19 p refs
(Contract F04701-71-C-0172)
(AD-743294; TR-0172(2230-20)-15; SAMSO-TR-72-126) Avail: NTIS CSCL 03/2

The solar oscillatory component has been observed at a wavelength of 3 mm by its modulation of the solar free-free emission. Observations were carried out separately at 3.3 and 3.5 mm with two different radio telescopes to rule out possible instrumental and atmospheric effects. Power spectra of the data show that the strongest spectral component is at 0.0055 Hz (period: 180 sec). These observations indicate that it is possible, by radio techniques, to extend observations of the solar oscillatory component to greater heights in the solar atmosphere than those previously observed in photospheric and low chromospheric spectral lines. Author (GRA)

N72-31804# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
DESIGN OF A NUMERICAL SOLAR DYNAMO MODEL Final Scientific Report, 1 Feb. 1969 - 31 Dec. 1971
Charles Tony Gordon 31 Jan. 1972 132 p refs
(Contract F19628-69-C-0042; AF Proj. 8608)
(AD-742290; AFCRL-72-0101) Avail: NTIS CSCL 03/2

A numerical, baroclinically driven, nonlinear, hydromagnetic dynamo model, which resembles Gilman's (1969) model, is formulated and applied to the sun. According to the baroclinic hypothesis, a stably stratified, but baroclinically unstable region is imbedded inside the convection zone. Because it is impossible at present to verify this rather adhoc hypothesis observationally, only the plausibility of a baroclinic dynamo model for the sun is investigated. More specifically, it is capable of simulating and maintaining the solar differential rotation and/or large scale solar magnetic fields. The model incorporates properties of fluid dynamos and of rotating geophysical fluids. GRA

N72-31805# Science Applications, Inc., La Jolla, Calif.
MODELS OF RADIATION TRANSPORT IN AIR: THE ATR CODE Final Report, 1 Apr. 1970 - 15 Nov. 1971
Robert J. Harris, Jr., James A. Lonergan, and Louis Huszar, Jr.

Nov. 1971 124 p refs
(Contract DASA01-70-C-0090)
(AD-743180; SAI-71-557-LJ; DNA-2803I) Avail: NTIS CSCL 18/8

The report describes the work to date on development of the ATR computer code - a user-oriented code for calculating quickly and simply radiation environment problems at all altitudes in the atmosphere. The ATR code is based on parametric models of a comprehensive data base of air base transport results which was generated using rigorous transport techniques for infinite homogeneous air. The effects of an air-ground interface and non-uniform air density are treated as perturbation corrections on homogeneous-air results. The data base has been generated for neutrons, secondary gamma-rays, high-energy photons and low energy photons as a function of space, energy and angle out to a range of 550 gm/squared cm of air. Parametric models have been developed for all of this data base except photon angular distribution and a version of ATR has been completed for neutron and secondary gamma-ray transport. Author (GRA)

N72-31393* Air Force Systems Command, Bedford, Mass. Space Physics Lab.
THE FLARE FORECASTING FIASCO: IS EVERYBODY LOOKING AT THE SAME SUN?
Frederick W. Ward, Jr. *In* NASA, Washington Phys. of the Space Environment 1972 p 157-171 (For availability see N72-31384 22-13)
CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-31806 Kodaikanal Observatory (India).
APSIDAL MOTION IN THE BINARY DELTA ORIONIS
V. Natarajan and R. Rajamohan 1971 7 p refs
(PDGO-11-208-365; Ser-A-Bull-208) Copyright. Avail: Issuing Activity

A velocity curve of the spectroscopic binary delta Orionis was obtained from the spectrograms taken at Kodaikanal during the years 1968 to 1970. The orbital elements derived are in good agreement with earlier values except for the longitude of periastron. The period of rotation of the line of apsides was found to be 208 years. Author

N72-31807*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ORBIT IMPROVEMENT FROM SATELLITE IMAGING DATA OBTAINABLE FROM THE MARINER/JUPITER/SATURN 1977 MISSIONS Final Report
Kaare Aksnes Jul. 1972 18 p refs
(Grant NGR-09-015-184; Contract JPL-BF-571747)
(NASA-CR-128065; SAO-207-070) Avail: NTIS HC $3.00 CSCL 03B

Equations of motion are established for a dynamic system in which a spacecraft flies close to and interacts with an outer planet and one or more of its satellites. For the computation of the state and mass partials needed in the orbit corrections, a set of variational equations is derived. These assume a notably compact form through the introduction of a matrix operator D. The above system of differential equations is integrated numerically on a computer. Author

N72-31808# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
SOME NEW RESULTS ON THE PLASMA-DYNAMICAL PROCESSES NEAR COMETS
Ludwig Biermann and Rhea Luest May 1972 18 p refs
(MPI-PAE/Astro-52) Avail: NTIS HC $3.00

The observed motions of cometary plasma structures and the three dimensional theory of plasma flow are discussed. The observations are applied to the interpretation of the Lyman alpha picture of the cometary hydrogen exosphere and to the determination of the flux of solar protons outside of the ecliptic plane. Author

N72-31809*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 16 MISSION ANOMALY REPORT NO. 1: OXIDIZER DESERVICING TANK FAILURE
Jun. 1972 37 p ref
(NASA-TM-X-68604; MSC-07032) Avail: NTIS HC $4.00 CSCL 22C

The command module reaction control system is emptied of all remaining propellant using ground support equipment designed to provide an acid/base neutralization of the propellant in both the liquid and gaseous phases so that it may be disposed of safely. During the deactivation operation of the oxidizer from the Apollo 16 command module on 7 May 1972, the scrubber tank of the decontamination unit exploded, destroying the ground support equipment unit and damaging the building that housed the operation. Only minor injuries were received by the personnel in the area and the command module was not damaged. Test results show that the failure was caused by an insufficient quantity of neutralizer for the quantity of oxidizer. This insufficiency lead to exothermic nitration-type reactions which produced large quantities of gas at a very high rate and failed the decontamination tank. Author

N72-31810*# National Aeronautics and Space Administration, Washington, D.C.
THE SCIENTIFIC RESULTS FROM THE ORBITING ASTRONOMICAL OBSERVATORY (OAO-2)
Arthur D. Code, ed. 1972 597 p refs Conf. held at Amherst, Mass., 23-24 Aug. 1971
(NASA-SP-310; LC-72-600185) Avail: NTIS HC $6.00 CSCL 03B

Scientific data from OAO 2 observations of the solar system, interstellar matter, stellar atmospheres, and galactic and extragalactic systems are presented. For individual titles, see N72-31811 through N72-31855.

N72-31811* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ULTRAVIOLET TELEVISION DATA FROM THE ORBITING ASTRONOMICAL OBSERVATORY. 1: INSTRUMENTATION AND ANALYSIS TECHNIQUES FOR THE CELESCOPE EXPERIMENT
R. J. Davis, W. A. Deutschman, C. A. Lundquist, Y. Nozawa, and Shelby D. Bass (Weston Instruments, Inc., Sarasota, Fla.) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 1-22 refs (For availability see N72-31810 22-30)
(Contract NAS5-1535)
CSCL 03B

The celescope instrumentation and data analysis system is described, the major problems encountered during orbital operation are summarized, and a few major problems that were anticipated but did not materialize are listed. Author

N72-31812* Wisconsin Univ., Madison.
ENGINEERING REPORT ON THE OAO-2 WISCONSIN EXPERIMENT PACKAGE
Curtis B. Bendell *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 23-38 refs (For availability see N72-31810 22-30)
(Contract NAS5-1348)
CSCL 03B

The continued useful operation of the OAO-2 Wisconsin Experiment Package (WEP) for almost three years after its December 1968 launch is evidence of a superior engineering accomplishment. Reliability features of the experiment concept and design which have contributed to its long life are presented. Data anomalies and partial failures are summarized along with conclusions regarding their causes. The thermal, vacuum and radiation effects of the space environment are shown to be minimal and quite localized within the WEP. Author

N72-31813* Wisconsin Univ., Madison.
THE UNIVERSITY OF WISCONSIN OAO OPERATING SYSTEM
Harry C. Heacox and John F. McNall *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 39-50 ref (For availability see N72-31810 22-30)
CSCL 03B

The Wisconsin OAO operating system is presented which consists of two parts: a computer program called HARUSPEX, which makes possible reasonably efficient and convenient operation of the package and ground operations equipment which provides real-time status monitoring, commanding and a quick look at the data. Author

N72-31814* Grumman Aerospace Corp., Bethpage, N.Y.
MEASUREMENTS OF THE EARTH'S AIRGLOW IN THE VACUUM ULTRAVIOLET c13
C. R. Waters and E. S. Fishburne *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 51-59 refs (For availability see N72-31810 22-30)
CSCL 04A

A valuable by-product of the OAO-2 astronomy mission has been the first extensive set of measurements of the earth's airglow between 1000 and 3000 A. These measurements, made with the Wisconsin experiment package, provide clues to the structure and chemistry of the upper atmosphere. The most significant results from these observations are: (1) the detailed altitude profile of the emissions from the dark and sunlit earth limb; and (2) the confirmation of recent theories concerning the source of the dayglow radiation between 1350 and 1700 A. Author

N72-31815* Michigan Univ., Ann Arbor.
TERRESTRIAL ATMOSPHERIC COMPOSITION FROM STELLAR OCCULTATIONS c13
P. B. Hays, R. G. Roble (Natl. Center for Atmospheric Res., Boulder, Colo.), and A. N. Shah *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 61-69 refs (For availability see N72-31810 22-30)
CSCL 04A

Stellar ultraviolet light transmitted through the upper mesosphere and lower thermosphere of the earth's atmosphere is primarily affected by the photoabsorption processes of ozone and molecular oxygen. The stellar ultraviolet photometers aboard the OAO-2 satellite have measured the intensity changes of several stars during occultation of the star by the earth. The measurements of the relative intensity change in certain atmospheric absorption bands are used to recover the vertical number density profiles of the absorbing species. Using the OAO-2 occultation data, the vertical number density profiles of molecular oxygen in the 100-200 km altitude region and ozone in the 60-100 km altitude region are determined. Author

N72-31816*+ Rutgers Univ., New Brunswick, N.J.
A COMPARISON OF SURFACE BRIGHTNESS MEASUREMENTS FROM OAO-2 AND OSO-6
F. E. Roach and C. F. Lillie (Colo. Univ., Boulder) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 71-79 refs Prepared in cooperation with Battelle-Northwest (For availability see N72-31810 22-30)
Avail: NTIS CSCL 03B

A comparison of surface brightness measurements of the night sky from the OAO-2 and OSO-6 satellites with ground observations shows good agreement between the space experiments but a systematic error in the zero point of the ground observations, indicating an additional atmospheric source of radiation. Author

N72-31817* Wisconsin Univ., Madison.
THE TEMPORAL CHARACTERISTICS OF THE TERRESTRIAL RADIATION BELT
John F. McNall *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 81-86 refs (For availability see N72-31810 22-30)
CSCL 03B

The terrestrial radiation belt effects on the detectors in the Wisconsin equipment are considered. The lowest dark count rate observed in orbit, compared with that measured in the thermal vacuum test on the ground, shows no measurable difference for the solar blind ASCOP 541-F photomultiplier tubes while the EMI-6256B tubes show an increase in minimum dark count of a factor of from 20 to 150 times that observed on the ground. All instruments are perturbed when in the South Atlantic anomaly, but the EMI tubes are by far the most sensitive to it. Indeed, the effect never goes away. Author

N72-31818* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ULTRAVIOLET PHOTOMETRY OF THE MOON WITH THE CELESCOPE EXPERIMENT ON THE OAO-2
I. A. Ahmad and W. A. Deutschman *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 87-94 refs (For availability see N72-31810 22-30)
(Contract NAS5-1535)
CSCL 03B

Thirteen television frames of the moon taken in the wavelength regions of 1350-2150 A by filter U sub 3 and 1050-2150 A by filter U sub 4 in the celescope experiment are discussed. The data include phase angles from -81 deg to -26 deg. The brightness dependence on phase angle differs slightly from that of visual observations. The brightness dependence on selenographical longitude is compared with the theoretical photometric function derived by Hapke. Author

N72-31819* Colorado Univ., Boulder.
OAO-2 OBSERVATIONS OF THE ZODIACAL LIGHT
Charles F. Lillie *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 95-108 refs (For availability see N72-31810 22-30)
CSCL 03B

Photometric measurements of the night sky brightness have been obtained at twelve wavelengths between 1000 A and 4300 A from above the earth's atmosphere. A preliminary analysis of the data reveals a component of the sky brightness with ecliptic symmetry and an intensity distribution similar to that of the zodiacal light. The ultraviolet spectrum of the zodiacal light can be closely approximated with a two component model in which one component has an albedo proportional to the wavelength lambda and the other component has a scattering efficiency proportional to lambda to the minus 19 power. Author

N72-31820* Wisconsin Univ., Madison.
ULTRAVIOLET OBSERVATIONS OF COMETS
Arthur D. Code, Theodore E. Houck, and Charles F. Lillie (Colo. Univ., Boulder) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 109-114 refs (For availability see N72-31810 22-30)
CSCL 03B

The first observations of a comet in the vacuum ultraviolet were obtained on January 14, 1970, when OAO-2 recorded the spectrum of the bright comet Tago-Sato-Kosaka (1969g). The observations revealed, among other things, the predicted extensive hydrogen Lyman alpha halo. OAO-2 continued to collect spectrophotometric measurements of this comet throughout

January of that year; a photograph of the nucleus in Lyman alpha revealed finer scale structures. In February of 1970, the bright comet Bennet (1969i) became favorable for space observations. On the basis of the OAO discovery, OGO-V made several measurements of comet Bennet with low spatial resolution photometers. Comet Enke was detected by OGO in January of 1971 at a large heliocentric distance from its Lyman alpha emission. Author

N72-31821* Kitt Peak National Observatory, Tucson, Ariz.
OBSERVATIONS OF VENUS, MARS, JUPITER AND SATURN LONGWARD OF 2000 A
L. Wallace, J. J. Caldwell (Wisconsin Univ., Madison), and Blair D. Savage (Wisconsin Univ., Madison) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 115-138 refs (For availability see N72-31810 22-30)
(Contract NAS5-1348)
CSCL 03A

A number of high quality spectra of Mars, Jupiter, the combined disk and rings of Saturn, as well as lower quality spectra of Venus, have been obtained with an objective grating spectrometer of the Wisconsin experiment package on OAO-2. An intercomparison of the Mars, Jupiter and Saturn spectra has failed to disclose any discrete planetary absorptions. Continuous albedos have been derived for the four planets by using OAO-2 observations of G-type stars for wavelengths greater than 2700 A and a new photoelectric solar spectrum for wavelengths smaller than 2700 A. The geometric albedo of Mars shows a steady increase below 3500 A which appears to be due to Rayleigh scattering combined with a decreasing surface reflectivity. The albedos of Venus, Jupiter and Saturn show a maximum in reflectivity in the region of 2500 A. Author

N72-31822* State Univ. of New York, Stony Brook.
MINOR CONSTITUENTS IN PLANETARY ATMOSPHERES: ULTRAVIOLET SPECTROSCOPY FROM THE ORBITING ASTRONOMICAL OBSERVATORY
Tobias Owen and Carl Sagan (Cornell Univ., Ithaca) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 139-157 refs (For availability see N72-31810 22-30)
(Contract NAS1-9683)
CSCL 03B

OAO data between 2000 A and 3600 A, obtained by the Wisconsin experimental package objective grating scanning spectrometer, are used to set upper limits to the abundances of many minor constituents in the atmospheres of Mars, Jupiter, Saturn, and Venus. Author

N72-31823* Smithsonian Astrophysical Observatory, Cambridge, Mass.
STELLAR ULTRAVIOLET COLORS AND INTERSTELLAR EXTINCTION
Eric Peytremann and Robert J. Davis *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 159-173 refs (For availability see N72-31810 22-30)
(Contract NAS5-1535)
CSCL 03A

A sample of celescope results is studied. Most of the sample stars belong to the Orion and Vela regions. Stars with visual excess E(B-V) less than 0.05 are selected in order to derive relationships of intrinsic color index versus spectral type. The resulting intrinsic color-color relations are compared with existing blanketed and unblanketed model calculations. Finally, the preceding intrinsic relations are utilized to derive some results on interstellar extinction. Owing to the rather large scatter in the celescope data, the Vela stars give the more significant results because their visible excess E(B-V) is, in general, larger than that for the Orion stars. Author

N72-31824* Wisconsin Univ., Madison.
INTERSTELLAR EXTINCTION IN THE ULTRAVIOLET
Robert C. Bless and Blair D. Savage *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 175-198 refs (For availability see N72-31810 22-30)
(Contract NAS5-1348)
CSCL 03A

Interstellar extinction curves over the region 3600-1100 A for 17 stars are presented. The observations were made by the two Wisconsin spectrometers onboard the OAO-2 with spectral resolutions of 10 A and 20 A. The extinction curves generally show a pronounced maximum at 2175 plus or minus 25 A, a broad minimum in the region 1800-1350 A, and finally a rapid rise to the far ultraviolet. Large extinction variations from star to star are found, especially in the far ultraviolet; however, with only two possible exceptions in this sample, the wavelength at the maximum of the extinction bump is essentially constant. These data are combined with visual and infrared observations to display the extinction behavior over a range in wavelength of about a factor of 20. Author

N72-31825* Toledo Univ., Ohio.
DIFFUSE GALACTIC LIGHT IN THE 1500-4200 ANGSTROM REGION
Adolf M. Witt and Charles F. Lillie (Colo. Univ., Boulder) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 199-205 refs (For availability see N72-31810 22-30)
CSCL 03B

Diffuse galactic light has been observed with the four stellar photometers of the OAO-2 in 29 of Kapteyn's selected areas. The data can be understood in terms of a wavelength dependent albedo of the interstellar grains with a pronounced minimum around 2200 A with a rapid increase towards unity at wavelengths below 2000 A. Author

N72-31826* Lockheed Missiles and Space Co., Palo Alto, Calif.
THE ULTRAVIOLET SPECTRUM OF THE CRAB NEBULA
Hugh M. Johnson *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 207-213 refs (For availability see N72-31810 22-30)
(Contract NASw-1977)
CSCL 03B

New observations of the Crab Nebula by OAO 2 stellar photometers are reported. Processed image data of the Crab give the logarithm of the integrated relative intensity per wavelength interval, corrected for sky background, and the rms error from 11 passbands in the ultraviolet range. The data are converted to logarithms of flux density per frequency interval and plotted on logarithmic scales with corrections for interstellar extinction. Author

N72-31827* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET PHOTOMETRY OF THE ECLIPSING VARIABLE CW CEPHEI
Stanley Sobieski *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 215-228 refs (For availability see N72-31810 22-30)
CSCL 03A

An extended series of photometric observations were made of the eclipsing variable CW Cephei using the Wisconsin instrument on OAO-2. Approximate elements which were derived based solely on the eclipse depths and shape of the secondary are in satisfactory agreement with those found using ground based observations. However, persistent asymmetries and anomalous light variations, all larger than the expected experimental error, were also found; subsequent ground-based observations show H sub alpha entirely in emission indicating the presence of an extended gaseous system surrounding one or both of the components. Consistent solutions utilizing all data at all wavelengths were not found. Author

N72-31828* Wisconsin Univ., Madison.
ULTRAVIOLET PHOTOMETRY OF PLANETARY NEBULAE
Albert V. Holm *In* NASA, Washington The Sci. Results from

the Orbiting Astron. Obs. (OAO-2) 1972 p 229-236 refs (For availability see N72-31810 22-30)
CSCL 03A

Nine of the planetary nebulae observed by the Wisconsin filter photometers are compared with 15 Monocerotis in the spectral region 1430-4250 A. The data are corrected for the degradation of the filters of stellar photometer number four with time. Comparisons with simple models indicate that most of the observed nebulae are subject to some interstellar extinction in the far ultraviolet. However, NGC 246 and NGC 1360 appear to be nearly unreddened. Thus far no unexpected features have been found in the observations. Author

N72-31829* Wisconsin Univ., Madison.
A SURVEY OF LOCAL INTERSTELLAR HYDROGEN FROM OAO-2 OBSERVATIONS OF LYMAN ALPHA ABSORPTION
Blair D. Savage and Edward B. Jenkins (Princeton Univ., N. J.) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 237-281 refs (For availability see N72-31810 22-30)
(Contracts NAS5-1348; NSR-31-001-901)
CSCL 03B

The Wisconsin far ultraviolet spectrometer aboard OAO-2 observed the wavelength region near 1216 A for 69 stars of spectral type B2 or earlier. From the strength of the observed interstellar L sub alpha absorption, atomic hydrogen column densities were derived over distances averaging 300 pc away from the sun. The OAO data were compared to synthetic ultraviolet spectra, originally derived from earlier higher resolution rocket observations, which were computer processed to simulate the effects of absorption by different amounts of hydrogen followed by the instrumental blending. Author

N72-31830* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY RESULTS ON INTERSTELLAR REDDENING AS DEDUCED FROM FILTER PHOTOMETRY
Michel Laget *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 283-294 refs (For availability see N72-31810 22-30)
CSCL 03A

Filter photometry has been used to derive the interstellar reddening law from stars through the study of a single spectral type, B0. The deficiency in the far ultraviolet flux of a supergiant relative to a main sequence star is compared with the difference in the flux distribution due to a change of one spectral class. Individual interstellar reddening curves show the general feature reported by Stecher (1969) and by Bless and Savage (1970). There is a large amount of scatter in the far ultraviolet which may be partially due to a real difference in interstellar extinction and partially due to observational inaccuracy. Author

N72-31831* Wisconsin Univ., Madison.
COLLECTIVE EXCITATIONS AND DUST PARTICLES IN SPACE
D. P. Gilra *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 295-319 refs (For availability see N72-31810 22-30)
CSCL 03B

It is shown that observed bands at 2200 A and in the 10 micron region are most probably due to collective excitations of dust particles. The following specific conclusions are drawn: (1) the 2200 A interstellar band is very likely due to graphite particles; (2) these graphite particles should be very small, approximately spherical, and should have no coating whatsoever; (3) the identification of circumstellar and interstellar silicates from the observations in the 10 micron region does not seem to be correct; (4) very valuable information about the shape of the circumstellar and interstellar dust particles can be obtained directly from observations; and (5) narrow band polarization measurements in the spectral regions of these bands will be very helpful in determining the shape of the particles. Author

N72-31832* Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE CELESCOPE CATALOG OF ULTRAVIOLET OBSERVATIONS
Robert J. Davis *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 321-345 refs (For availability see N72-31810 22-30)
CSCL 03A

Data obtained from approximately 7500 ultraviolet television pictures are used to compile a celescope catalog of ultraviolet observations. This catalog lists the magnitude as observed in each of celescope's four ultraviolet color bands, the standard deviations of the observed ultraviolet magnitudes, positions, identifications, and ground based magnitudes, colors, and spectral types for approximately 5000 stars. Author

N72-31833* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE ULTRAVIOLET SPECTROPHOTOMETRY OF ALPHA CANIS MAJORIS, GAMMA ORIONIS, KAPPA ORIONIS AND ALPHA LEONIS
Dennis C. Evans *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 347-360 refs (For availability see N72-31810 22-30)
CSCL 03A

Spectral observations of the stars Alpha Canis Majoris, Gamma Orionis, Kappa Orionis and Alpha Leonis have been obtained in the range 1150-4000 A, using rocket borne spectrometers. The payloads have a 13-inch diameter telescope, a rotatable concave diffraction grating, and three pulse counting photomultiplier photometers. The observations are systematically lower than those of Carruthers (1968) at 1270 A, of Smith (1967) at 1376 A, and of Campbell (1970) at 2150 and 2550 A. The data are also about 15 percent lower than the ground-based photometry reported by Schild, Peterson and Oke (1971). The OAO-2 short wavelength scanner calibration agrees with the alpha Leo observations, but disagrees for Kappa Ori and Gamma Ori. Author

N72-31834* Wisconsin Univ., Madison.
ABSOLUTE CALIBRATION OF ULTRAVIOLET FILTER PHOTOMETRY
R. C. Bless, T. Fairchild, and A. D. Code *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 361-365 refs (For availability see N72-31810 22-30)
CSCL 03A

The essential features of the calibration procedure can be divided into three parts. First, the shape of the bandpass of each photometer was determined by measuring the transmissions of the individual optical components and also by measuring the response of the photometer as a whole. Secondly, each photometer was placed in the essentially-collimated synchrotron radiation bundle maintained at a constant intensity level, and the output signal was determined from about 100 points on the objective. Finally, two or three points on the objective were illuminated by synchrotron radiation at several different intensity levels covering the dynamic range of the photometers. The output signals were placed on an absolute basis by the electron counting technique described earlier. Author

N72-31835* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NEAR ULTRAVIOLET SPECTRUM OF B AND A TYPE MAIN SEQUENCE STARS
Anne B. Underhill *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 367-376 refs (For availability see N72-31810 22-30)
CSCL 03A

Scans of lambda Lep, eta UMa, xi Dra, epsilon Dor, alpha Leo, phi Dra, upsilon Dra, beta Aur, alpha Pic and alpha Dor have been obtained with scanner OAO-2 over the range 1800-3600 A. These scans have been reduced to tracings of F sub lambda in the 20 A pass band vs. wavelength using a

wavelength conversion scale and a relative spectral sensitivity function. The general trend of the relative flux plots compares well with the continua predicted by simple model atmospheres.
Author

N72-31836* Smithsonian Astrophysical Observatory, Cambridge, Mass.
THEORETICAL EFFECT OF VARIOUS BROADENING PARAMETERS ON ULTRAVIOLET LINE PROFILES
Eric Peytremann *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 377-391 refs (For availability see N72-31810 22-30)
(Contract NAS5-1535)
CSCL 03A

The relative importance of various damping parameters in ultraviolet lines under conditions of normal stellar atmospheres are studied. It is found that the damping by electron collisions is always much smaller than either the radiative or the classical damping, except for lines that arise from high excitation levels and do not therefore develop strong damping wings. A damping constant equal to 10 times the classical value is always much too large when compared to the more realistic (electron + radiative) damping.
Author

N72-31837* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN UNUSUAL ABSORPTION FEATURE IN THE FAR ULTRAVIOLET SPECTRUM OF EARLY TYPE SUPERGIANTS
A. B. Underhill, D. S. Leckrone, and D. K. West *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 393-404 refs (For availability see N72-31810 22-30)
CSCL 03A

The OAO-2 satellite has been used to obtain far ultraviolet scans of six early-type supergiants. The data reveal the presence of a distinct, broad absorption feature centered near 1720 A. This feature is unique in that it remains essentially constant in strength, breadth and central position over the spectral type range B0 I to A2 I. The feature also appears in the spectrum of the B-type shell star beta Tauri, with a strength comparable to that observed for the supergiants. It appears weakly, or not at all, in the B and A main sequence spectra we have examined. The hypothesis that the feature is due to a fortuitous blend of intrinsically strong lines arising primarily from the ground configurations of abundant metallic ions is discussed in detail.
Author

N72-31838* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ENERGY DISTRIBUTIONS AND SPECTRA OF ORION B STARS
Rudolph E. Schild and Frederic Chaffee *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 405-409 (For availability see N72-31810 22-30)
CSCL 03A

New MK spectral types and energy distributions are presented for B stars in Orion for which far ultraviolet flux excesses have recently been discovered. Significant differences between HD spectral energy distributions show the Orion late B stars to have smaller Balmer discontinuities than do field stars of the same spectral types. For the late B stars, these effects cause the 1500 A fluxes to be under-estimated by approximately 0.5 mag. No comparable systematic effects were found for the early B stars.
Author

N72-31839* Wisconsin Univ., Madison.
PHOTOMETRY OF LATE TYPE STARS
Lowell R. Doherty *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 411-428 refs (For availability see N72-31810 22-30)
(Contract NAS5-1348)
CSCL 03A

Broad band filter photometry for 57 bright stars of spectral type A2 discussed with peak instrument responses at 3320, 2980, 2460 and 1910 A. The data include nearly all usable filter observations of G, K and M types. Sampling is nearly complete for A and F giants and supergiants, with the exception of Cepheid variables. The basic results presented are relative digital counting rates obtained with a field-stop aperture of 10 minutes of arc. Characteristics of the four filter-photometer combinations and errors are discussed. Some observations require substantial correction if they are to represent the visually brightest star in the field. These corrections and the effects of interstellar reddening are discussed. The adjusted counts are then used to construct color-color diagrams and are compared to the recent SAO grid of model atmospheres.
Author

N72-31840* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HD 50896 AND THE COMPOSITION OF WOLF-RAYET ATMOSPHERES
Lindsey F. Smith *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 429-440 refs (For availability see N72-31810 22-30)
CSCL 03B

Measurements of the Pickering lines of He II in the spectrum of HD 50896 suggest that the upper limit to the H/He ratio is 0.05 by numbers. Spectral scans from OAO-2 show strong lines, nitrogen being observed most strongly as N IV, but also as N III and N V. Carbon and oxygen are observed dominantly in the triply ionized states. Thus, the degree of ionization of C, N and O are comparable. No indication of extensive selective excitation effects is observed. It is concluded that the differences between the WN and WC stars cannot be explained by selective excitation or ionization effects in the WN stars.
Author

N72-31841* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OAO-2 OBSERVATIONS OF C III 1909 A LINE IN GAMMA 2 VELORUM
Donald K. West *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) 1972 p 441-447 refs (For availability see N72-31810 22-30)
CSCL 03B

The C III 1909 A emission line in gamma 2 Velorum was observed over a period of 24 hours in an attempt to find short period time variability. Analysis of this data found no periods in the range of 0.5 to 200 minutes, and placed an upper limit of 3% on the amplitude of the stellar pulsations. Improved spectral resolution data for this line was obtained by offsetting the OAO-2 pointing in steps of 15 seconds of arc. The line profile derived by combining this offset data with the slit function shows a definite asymmetry. Although the improved resolution gives results which are barely sufficient for comparison with the prediction from model envelopes, some information concerning the abundance of carbon and the physical conditions of the envelope can be gained.
Author

N72-31842* Colorado Univ., Boulder.
METAL LINE BLANKETING AND OPACITY IN THE ULTRAVIOLET OF ALPHA 2 CANUM VENATICORUM
Michael R. Molnar *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 449-460 refs (For availability see N72-31810 22-30)
CSCL 03B

Ultraviolet photometry by OAO-2 was made of alpha 2 CVn covering the entire 5.5d period of this magnetic Ap variable. The light curves ranging from 1330 A to 3320 A indicate the dominant role of rare-earth line-blanketing in redistributing flux. In a broad depression of the continuum covering 2300-2600 A, scanner observations possibly identify strong lines of Eu III as major contributors to this feature. At maximum intensity of the rare-earth lines, the ultraviolet continuum shortward of 2900 A is greatly diminished while the longer wavelength regions into the visual become brighter. In addition, there is evidence that the

hydrogen line opacity is variable and the photoionization edge of Si I at 1680 A is identified. Author

N72-31843* Case Western Reserve Univ., Cleveland, Ohio.
COMPARISON OF CELESCOPE MAGNITUDES WITH MODEL ATMOSPHERE FLUXES FOR A, F AND G SUPERGIANTS
Sidney B. Parsons (Warner and Swasey Obs.) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 461-463 refs (For availability see N72-31810 22-30)
CSCL 03B

Comparison between theoretical colors calculated from model atmospheres and ultraviolet celescope observations of supergiant star atmospheres show that most stars are deficient in ultraviolet flux relative to theoretical models. It is concluded that not enough line blocking has been included in model atmospheres. G.G.

N72-31844* Wisconsin Univ., Madison.
Mg II 2800 A EMISSION IN LATE TYPE STARS
Lowell R. Doherty *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 465-473 refs (For availability see N72-31810 22-30)
(Contract NAS5-1348)
CSCL 03B

The largest body of data on ultraviolet spectra of late-type stars now available is the series of scans made with the long wavelength spectrometer onboard OAO-2. Some features of selected scans from this series and estimates of Mg II emission fluxes were reported earlier. Since that time, the effects of sky background, scattered light and variable instrumental sensitivity have become better understood. Additional stars are used to define more clearly the transition from Mg II 2800 A absorption to emission with advancing spectral type, and additional scans of alpha Sco provide a better estimate of Mg II emission strength for this supergiant in OAO observations. Author

N72-31845* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET OBSERVATIONS OF BETA CANIS MAJORIS AND BETA CEPHEI
D. Fischel and W. M. Sparks *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 475-478 ref (For availability see N72-31810 22-30)
CSCL 03A

Ultraviolet spectra of the two variables exhibit periodic variations in the H I, Si IV, and C IV resonance lines. Later scans of the beta Cep atmosphere show that the C IV line disappeared for short periods. Three possible mechanisms for this effect are: a beat phenomenon, shock waves, or tidal distortions. It is concluded that a tidal distortion is possible if the period of revolution is 12 days and if the inclination is sufficiently small to keep one tidal bulge out of sight and large enough to keep the secondary from eclipsing the primary bulge. G.G.

N72-31846* Wisconsin Univ., Madison.
SPECTROPHOTOMETRY OF BETA LYRAE
Theodore E. Houck *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 479-484 ref (For availability see N72-31810 22-30)
CSCL 03A

Two hundred and fourteen scans over the wavelength region 1100 A to 1800 A with 10 A resolution were obtained by OAO spacecraft for the eclipsing binary Beta Lyrae between JD 2440889.5 and JD 2440904.5. Preliminary results indicate that: (1) The intensity at primary minimum is almost exactly one-half that at maximum and that the primary eclipse is less deep than that in the visual or longer ultraviolet wavelengths; (2) except for the 1100 to 1200 A region, the depth of the primary eclipse appears independent of wavelength; (3) the energy distribution at secondary minimum is similar to that at primary; (4) the two most prominent emission lines match well both with Si IV and C IV emission observed in gamma Vel and imply an exciting source of high temperature; (5) the emission lines do not show variation with phase. Author

N72-31847* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OAO-2 OBSERVATIONS OF BETA LYRAE AND A PROVISIONAL INTERPRETATION
Yoji Kondo, George E. McCluskey, Jr. (Lehigh Univ.), and Theodore E. Houck (Wisconsin Univ., Madison) *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 485-494 refs (For availability see N72-31810 22-30)
CSCL 03A

Six-color ultraviolet photoelectric observations of beta Lyrae obtained with OAO-2 are presented. These observations, made at 1380, 1500, 1920, 2460, 2980 and 3330 A, represent the first truly continual coverage of the light changes of beta Lyrae during one orbital revolution and were obtained in November 1970. The photometric data are supplemented by spectral scans in the wavelength intervals 3800-1800 A and 2000-1050 A; the latter interval was scanned at 10 A resolution once during every OAO-2 orbit, i.e., about 100 minutes. Anomalous features, such as asymmetries and short and long term variations, are present in the light curves. A tentative discussion of solutions of the light curves is given. Author

N72-31848* Arizona Univ., Tucson.
BALMER CONTINUOUS EMISSION AND POLARIZATION IN Be STARS
George V. Coyne *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 495-504 refs (For availability see N72-31810 22-30)
CSCL 03A

Observations by OAO-2 of two Be stars, gamma Cassiopeiae and 60 Cygni, are analyzed to show that unpolarized radiation produced by Balmer continuous emission in the extended atmospheres of Be stars is probably a significant factor in explaining the polarization observed shortwards of the Balmer discontinuity. The ratio of the energy flux of Be stars to normal B stars with the same amount of reddening varies from about 1.4 at 3600 A to 1.05 at 2500 A. This is interpreted as due to Balmer continuous emission in the Be stars. For gamma Cas the polarizations at 3300 and 3600 A are respectively 0.6 and 0.7 of the values one expects from interstellar polarization. Author

N72-31849* Wisconsin Univ., Madison.
PRELIMINARY RESULTS OF ULTRAVIOLET PHOTOMETRY OF SHELL STARS
Robert L. Bottemiller *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 505-514 refs (For availability see N72-31810 22-30)
CSCL 03A

Photometry of 40 B stars acquired by the OAO-2 has been examined for systematic differences between the 25 standard stars and 15 program objects. The latter include shell and Be stars and a few objects with at least a modest infrared excess. Although individual deviations did occur, no definite distinction between the program and comparison stars was found. A possible, but very weak, tendency for the program objects to lie somewhat below the standards in color-color plots is discussed, especially with reference to errors of misclassification and variability of the ultraviolet reddening law. Author

N72-31850* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET OBSERVATIONS OF WEAK-HELIUM STARS
P. L. Bernacca and Michael R. Molnar (Lab. for Atmospheric and Space Phys.) *In its* The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 515-534 refs (For availability see N72-31810 22-30)
CSCL 03A

Ultraviolet filter photometry aboard OAO-2 has been carried out for the weak helium stars 3 Cen A, 3 Sco, HD 144334, HD 21699, HD 144844, alpha Scl, HR 8535, HR 8770 and HD 144661. The flux distribution is compared with that of B3 to B8 main sequence and giant stars in terms of color-color diagrams. When allowance is made for line blocking shortward of 2800 A that most of the weak helium stars have normal fluxes in good agreement with their ground-based colors. The star alpha Scl is a light and spectrum variable. The strengthening of Ti II and Sr II lines around 2400 A appears to redistribute flux longward of the Balmer discontinuity. The flux distribution indicates an effective temperature about 1500 K higher than previously determined.
Author

N72-31851* Wisconsin Univ., Madison.
ULTRAVIOLET PHOTOMETRY OF NOVA SERPENTIS 1970
Arthur D. Code *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 535-540 refs (For availability see N72-31810 22-30)
CSCL 03A

The appearance of the bright nova, Nova Serpentis 1970, provided the first opportunity to obtain spectrophotometric observations of a nova in the vacuum ultraviolet. OAO-2 carried out systematic measurements from shortly after outburst on through the first sixty days of nova activity. This data consist of filter photometry and spectral scans. General characteristics of the light and spectral variations in the ultraviolet exhibited by this set of data are described.
Author

N72-31852* Wesleyan Univ., Middletown, Conn.
ULTRAVIOLET PHOTOMETRY OF GLOBULAR CLUSTERS
G. A. Welch and A. D. Code (Wisconsin Univ., Madison) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 541-558 refs (For availability see N72-31810 22-30)
CSCL 03A

Filter photometry measurements of the integrated light from several globular clusters between 1500 and 4000 A are discussed. The techniques and problems associated with carrying out photometry of faint extended sources with the OAO-2 instrumentation are described first. The energy distribution for globular clusters determined from these data are corrected for interstellar extinction on the basis of B-V color excesses and a mean ultraviolet extinction curve. The results are compared with synthetic cluster calculations. The ultraviolet energy distribution is primarily determined by the number of stars at the blue end of the horizontal branch.
Author

N72-31853* Wisconsin Univ., Madison.
PRELIMINARY RESULTS OF OAO ULTRAVIOLET PHOTOELECTRIC PHOTOMETRY OF GALAXIES
A. D. Code, G. A. Welch (Wesleyan Univ.), and T. L. Page (NRL, Washington, D. C.) *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 559-574 refs (For availability see N72-31810 22-30)
CSCL 03A

General results are presented based on nearly completed reductions of data for approximately 35 galaxies of all Hubble types. In general the visual and ultraviolet energy distributions are well correlated. The energy distribution in late-type galaxies appears to turn up sharply in the region around 2000 A, and this is tentatively interpreted as due to the presence of early-type stars whose energy distribution is modified by interstellar dust within these objects. Similar turnups may be present in several elliptical galaxies but the evidence at this time is not definitive.
Author

N72-31854* Texas Univ., Dallas.
POSSIBILITY THAT THE FAR ULTRAVIOLET EXCESS IN M31 IS DUE TO MAIN SEQUENCE STARS
Beatrice M. Tinsley *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 575-581 refs (For availability see N72-31810 22-30)
CSCL 03A

The far ultraviolet excess in the central region of M31, observed by OAO-2, could be due to young main sequence stars. More than enough such stars are present in the model for the M31 inner disk population derived by Tinsley and Spinrad (1971) to match line- and color-indices at longer wavelengths. If the far ultraviolet radiation of typical galaxies arises from young stars, the theoretical ultraviolet background is enhanced greatly by evolutionary effects. For evolution at the rate of Tinsley and Spinrad's model for M31, or of Arnett's (1971) linear model for our galaxy, the enhancement is a factor 2.5 to 14, depending on the Hubble constant and the spectrum at wavelengths below 1700 A.
Author

N72-31855* Colorado Univ., Boulder.
THE EXTRAGALACTIC COMPONENT OF THE ULTRAVIOLET SKY BRIGHTNESS
Charles F. Lillie *In* NASA, Washington The Sci. Results from the Orbiting Astron. Obs. (OAO-2) Jan. 1972 p 583-590 refs (For availability see N72-31810 22-30)
(Grant NGR-06-003-179)
CSCL 03B

The surface brightness of the night sky has been measured at 12 wavelengths in the 1250-4300 A spectral region with the stellar photometers on OAO-2. From observations at high galactic latitudes it is possible to set upper limits on the brightness of the extragalactic sky background at several wavelengths. In the wavelength range 1420-1680 A the extragalactic background is not greater than 1.2 x 10 to the minus eight power cm/2 s/1 ster/1 A/1. Observations of near-by galaxies with OAO-2 are used to predict the background due to extragalactic nebulae. It is shown that instruments which are an order of magnitude more sensitive would be required to detect the extragalactic component of the light of the night sky.
Author

N72-31856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
VEHICLE MANAGEMENT AND MISSION PLANNING SYSTEMS WITH SHUTTLE APPLICATIONS
8 Mar. 1972 82 p
(NASA-TM-X-68607; MSC-IN-72-FM-62; MSC-06095) Avail: NTIS HC $6.25 CSCL 22A

A preliminary definition of a concept for an automated system is presented that will support the effective management and planning of space shuttle operations. It is called the Vehicle Management and Mission Planning System (VMMPS). In addition to defining the system and its functions, some of the software requirements of the system are identified and a phased and evolutionary method is recommended for software design, development, and implementation. The concept is composed of eight software subsystems supervised by an executive system. These subsystems are mission design and analysis, flight scheduler, launch operations, vehicle operations, payload support operations, crew support, information management, and flight operations support. In addition to presenting the proposed system, a discussion of the evolutionary software development philosophy that the Mission Planning and Analysis Division (MPAD) would propose to use in developing the required supporting software is included. A preliminary software development schedule is also included.
Author

N72-31857# Joint Publications Research Service, Arlington, Va.
STUDIES OF CIRCULAR ORBIT MOTION
24 Aug. 1972 35 p refs Transl. into ENGLISH from Mekh. Tverdogo Tela (USSR), no. 3, 1967 p 152-157; from Byull. Inst. Teor. Astron. (Leningrad), vol. 10, no. 8 (121), 1966 p 516-522; and from Uch. Zap., Permsk. Goz. Univ. (Perm), no. 136, 1966 p 21-25 and 100-105
(JPRS-56857) Avail: NTIS HC $3.75

Articles on circular orbit motion involving stability analysis and the passage and encounter of points including those with

variable mass and parallel approach are reported. For individual titles, see N72-31858 through N72-31861.

N72-31858 Joint Publications Research Service, Arlington, Va.
NEARLY CIRCULAR ORBITAL MOTION WITH STORED-ENERGY PROPULSION SYSTEMS AND CONSTANT-OUTPUT-POWER ENGINE
B. N. Kiforenko *In its* Studies of Circular Orbit Motion 24 Aug. 1972 p 1-9 refs (For availability see N72-31857 22-30)

Constant-output power propulsions with stored energy for maneuvers in near-earth space are examined for the dynamic values of the coordinates and velocities which differ from corresponding values in free motion along a circular orbit. The equations for determining the angular displacement, and the time for performing the maneuver are given, and charts are presented that can be used to calculate parameters for solving orbital plane skew. F.O.S.

N72-31859 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF THE STABILITY OF CIRCULAR ORBITS IN THE PROBLEM OF TWO FIXED CENTERS
V. G. Degtyarev and L. S. Yevdokimova *In its* Studies of Circular Orbit Motion 24 Aug. 1972 p 10-20 refs (For availability see N72-31857 22-30)

The stability of the circular orbits in the problem of two fixed centers was analyzed. The regions of stability and instability are plotted. The masses of the fixed centers m sub 1 and m sub 2 are postulated to be both positive and negative. When m sub 1 > 0, and m sub 2 > 0, it is proved that circular orbits are stable, if 0 < gamma < 0.435; 0 < Z < a(gamma), or 0.565 < gamma < 1; a(gamma) < Z < a, where gamma = m sub 2/m sub 1 + m sub 2, and Oz are lines of centers. Author

N72-31860 Joint Publications Research Service, Arlington, Va.
PASSAGE AND ENCOUNTER OF POINTS OF VARIABLE MASS ON A CIRCULAR ORBIT WITH PARALLEL APPROACH
I. F. Vereshchagin and A. P. Ivanov *In its* Studies of Circular Orbit Motion 24 Aug. 1972 p 21-27 refs (For availability see N72-31857 22-30)

The transition of a point from a circular orbit and rendezvous with a point in a circular coplanar orbit is considered in a gravitational field. The equations for the engagement time, and point are derived along with the equations for determining the conditions for soft docking in orbit. F.O.S.

N72-31861 Joint Publications Research Service, Arlington, Va.
APPROACH OF TWO POINTS ON A CIRCULAR ORBIT
D. A. Semenov *In its* Studies of Circular Orbit Motion 24 Aug. 1972 p 28-35 ref (For availability see N72-31857 22-30)

The laws for closing of two points in a circular orbit in a central gravitational force field are established for variations in mass for various types of initial conditions. Author

N72-31862*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ESTIMATES OF NITRIC OXIDE PRODUCTION FOR LIFTING SPACECRAFT REENTRY
Chul Park Jul. 1971 37 p refs
(NASA-TM-X-62052) Avail: NTIS HC $4.00 CSCL 22A

The amount of nitric oxide which may be produced by heating of air during an atmospheric reentry of a lifting spacecraft is estimated by three different methods. Two assume nitrogen fixation by the process of sudden freezing, and the third is a computer calculation using chemical rate equations. Author

N72-31863*# GCA Corp., Bedford, Mass. Technology Div.
MASS SPECTROMETRIC DETERMINATION OF THE COMPOSITION OF THE VENUS CLOUDS Quarterly Progress Report, 4 Apr. - 4 Jul. 1972
4 Jul. 1972 6 p ref
(Contract NAS5-23099)
(NASA-CR-122461; QPR-1) Avail: NTIS HC $3.00 CSCL 03B

The design of a mass spectrometer, based on the results of the Venera and Mariner probes, with sensitivity high enough to detect the HCl in the Venus atmosphere is discussed. One way to analyze the clouds is by the introduction of the atmosphere with cloud particles through a molecular leak into the mass spectrometer. The analysis can be performed in regular Nier-type ion sources with the electrodes of materials which are completely free of Cl and F. The problem of preventing the blockage of the capillaries to the Nier type ion source is also considered. F.O.S.

N72-31864*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LUNAR EPHEMERIS AND SELENOGRAPHIC COORDINATES OF THE EARTH AND SUN FOR 1983 AND 1984
Ann D. Hartung Washington 1972 437 p refs
(NASA-SP-3063) Avail: NTIS HC $6.00 CSCL 03B

Ephemeris data are presented in sections for each month for 1983 and 1984 to provide a time history of lunar coordinates and related geometric information. A NASA Manned Spacecraft Center modification of an ephemeris tape was used to calculate and plot coordinates of the earth, moon, and sun. The ephemeris is referenced to the mean vernal equinox at the nearest beginning of a Besselian year. Therefore, the reference equinox changes from one year to the next between 30 June and 1 July. The apparent discontinuity in the data is not noticeable in the graphical presentation, but can be observed in the digital output. The mean equator of epoch is used in all cases. The computer program used to compute and plot the ephemeris data is described in the appendix. Author

N72-31865# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
LARGE-SCALE MOTIONS IN CONVECTION BELTS OF STARS AND LARGE PLANETS
B. S. Keller and I. M. Yavorskaya 1972 60 p refs In RUSSIAN
Avail: NTIS HC $5.00

Large scale axisymmetric motions induced in convective envelopes of stars and atmospheres of large planets by interaction of rotation with turbulent convection were investigated. These motions are described by nonlinear partial differential Reynolds equations with appropriate boundary conditions at the two spherical surfaces. Generalized to the three-dimensional case, the semiempirical mixing length Prandtl's theory was used to express the turbulent stresses linearly in terms of velocity gradients. The equations obtained yield meridional calculations and angular velocity distributions on strong stratified zones, where the ratio of the centrifugal force to the gravity is small, and effective viscosity is sufficiently large. The results are used for the calculation of the meridional circulation in the sun's convective envelope and the angular velocities of its surface. Author

N72-31866*# Israel Program for Scientific Translations, Ltd., Jerusalem.
SPACE RESEARCH: PHYSICAL AND TECHNICAL PRINCIPLES
M. G. Kroshkin 1972 315 p refs Transl. into ENGLISH of the publ. "Fiziko-tekhnicheskie osnovy kosmicheskikh issledovanii" Moscow, mashinostr., 1969 Sponsored by NASA and NSF
(NASA-TT-F-660; TT-70-50188) Avail: NTIS HC $6.00 CSCL 03B

Experimental data on the space around the earth and interplanetary space, based mainly on rocket and satellite observations, are presented. First the basic physical parameters of the medium or phenomena are considered, and then the parameters of phenomena which, since they are dependent to some degree on the basic ones, have in turn a corresponding influence on others. Characteristics which are completely independent of, or only slightly dependent on, the others and thus do not affect them, are described. The results of a study of

the effects which specific conditions in space have on the materials, structural elements, and systems of spacecraft are presented. These effects also cause the main specific difficulties and problems that must be overcome while developing spacecraft and carrying out space research. Author

N72-31867*# California Univ., Los Angeles. Plasma Physics Group.
MAGNETOSPHERE OF THE OUTER PLANETS
C. F. Kennel May 1972 49 p refs
(Grants NGL-05-007-190; NGR-05-007-116; Contracts N00014-69-A-0200-4023; AT(04-3)-34; Grant NSF GP-22817)
(NASA-CR-122471; PPG-120) Avail: NTIS HC $4.50 CSCL 03B

Scaling laws for possible outer planet magnetospheres are derived. These suggest that convection and its associated auroral effects will play a relatively smaller role than at earth, and that there is a possibility that they could have significant radiation belts of energetic trapped particles. Author

N72-31868*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL OF THE LOCAL REGION OF THE GALAXY
J. C. Novaco and N. R. Vandenberg (Md. Univ.) Sep. 1972 20 p refs
(NASA-TM-X-66011; X-693-72-8) Avail: NTIS HC $3.00 CSCL 03B

A two-component model of the local interstellar medium was developed, based on the Radio Astronomy Explorer (RAE-1) satellite observations of the low frequency (0.2 - 10 MHz) galactic radio background spectrum. The model shows evidence for a thick spiral arm and a thick electron disk of 600 and 1200 pc slab thicknesses, respectively. The temperature difference between the north galactic pole and anticenter directions supports the concept of a local positive thermal gradient away from the galactic plane. A preliminary discussion of the influence of the Razin effect on the model is also presented. Author

N72-31869# Aerospace Corp., El Segundo, Calif.
OBSERVATIONS OF THE 1.4 mm BRIGHTNESS DISTRIBUTION OF THE SUN Technical Report, Oct. 1967 - Oct. 1968
Fred I. Shimabukuro 25 May 1972 20 p refs
(Contract F04701-71-C-0172)
(AD-742982; TR-0172(2230-20)-17; SAMSO-TR-71-119) Avail: NTIS CSCL 03/2

Observations of the 1.4 mm center to limb solar brightness distribution shows that there is little, if any, limb brightening at this wave length. Knowledge of the antenna radiation pattern is vital in interpreting the radio measurements. Author (GRA)

N72-31870# Kitt Peak National Observatory, Tucson, Ariz.
FOUR-COLOR AND H BETA PHOTOMETRY FOR THE BRIGHTER AO TYPE STARS Final Report
D. L. Crawford, J. V. Barnes, J. Gibson, J. C. Golson, C. L. Perry, and M. L. Crawford 21 May 1971 30 p refs Sponsored in part by NSF
(Contract N00014-67-C-0176; NR Proj. 046-823)
(AD-740858) Avail: NTIS CSCL 03/2

Intermediate and narrow band photoelectric photometry is presented for 572 AO-type stars brighter than m sub v = 6.5m. Author (GRA)

N72-31871# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
OBSERVATIONS OF GALACTIC INFRARED SOURCES
M. O. Harwit, James R. Houck, Judith L. Pipher, and Baruch T. Soifer 1 Nov. 1971 28 p refs
(Contract F19628-70-C-0128; ARPA Order 1366; AF Proj. 8692)
(AD-740848; AFCRL-71-0591; DR-1) Avail: NTIS CSCL 03/2

The report consists of two parts and represents two scientific papers which present the results obtained in the July 16, 1971 flight of the Aerobee 170 rocket. The reports are titled Rocket Infrared 4-Color Photometry of the Galaxy's Central Regions, and Why Many Infrared Astronomical Sources Emit at 100 micrometers. Author (GRA)

N72-31872# Paris Observatory, Meudon (France).
[ANALYSIS OF EARLY BALMER LINE SPECTRA] Final Technical Report
J. C. Pecker, S. R. Pottasch, J. Rountree-Lesh, and B. Folkart 1972 8 p
(Grants Nonr(G)-0001-60; Nonr(G)-0022-62; NR Proj. 046-777)
(AD-740884) Avail: NTIS CSCL 03/2

The authors have proceeded to a more detailed analysis of the solar spectra in order to examine the characteristics of certain lines as a function of time. The plates, as well as the corresponding calibration data, have been converted by means of the microphotometer so as to give a geometrical representation of the relative brightness of any given part of the spectrum. Having reduced the spectra to the form intensity vs wavelength, the authors have proceeded to the analysis of individual line profiles, which we have determined as a function, in wavelength, of the line intensity related to the continuum intensity. Author (GRA)

N72-31873# Pennsylvania State Univ., University Park. Dept. of Astronomy.
CONVECTION IN STELLAR ATMOSPHERES
Larry D. Travis and Satoshi Matsushima Sep. 1971 221 p refs
(Grants NSF GP-18938; NSF GP-8058)
(PB-209254; SR-024) Avail: NTIS HC $3.00 CSCL 03B

The improved numerical method is used to construct a number of flux constant models for both the local and generalized mixing length theories. Numerical results indicate that for the same mixing length ratio, the generalized theory leads to a significantly larger convective flux in the important regions of the atmosphere than does the purely local treatment. Consequently, a comparison with solar observations suggests that the maximum mixing length ratio consistent with observations is approximately 0.35. Due to this upper limit on the mixing length ratio, it is found that the effect of convection upon the cool main sequence stars is secondary compared to other effects such as unknown UV opacity and line blanketing. Author (GRA)

N72-31874# Naval Ordnance Lab., White Oak, Md.
BIBLIOGRAPHY ON SHOCK WAVE PROPAGATION IN A NONHOMOGENEOUS ATMOSPHERE
D. L. Lehto 17 Apr. 1972 16 p refs
(AD-742772; NOLTR-72-96) Avail: NTIS CSCL 20/4

One hundred references are listed on shock wave propagation in gases such as the earth's atmosphere, and stellar and planetary atmospheres, whose density, pressure, temperature, and other characteristics vary slowly with position. Author (GRA)

N72-31965* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODELS FOR THE ATMOSPHERES OF JUPITER AND SATURN
N. Divine and F. D. Palluconi *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 1-8 refs (For availability see N72-31964 22-34)
CSCL 03B

N72-31966* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AIMING STRATEGIES FOR QUARANTINED MULTIPLANET MISSIONS
N. P. Dwivedi *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 9-17 ref (For availability see N72-31964 22-34)
CSCL 22A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-31875*# Michigan Univ., Ann Arbor. Coll. of Engineering.
SOUNDING ROCKET FLIGHT REPORT: MUMP 9 AND MUMP 10
H. J. Grassl Nov. 1971 56 p refs
(Contract NAS5-11073; ORA Proj. 089020)
(NASA-CR-122520; Rept-089020-1-R) Avail: NTIS HC $5.00 CSCL 22B

The results of the launching of two Marshall-University of Michigan Probes (MUMP 9 and MUMP 10), Nike-Tomahawk sounding rocket payloads, are summarized. The MUMP 9 payload included an omegatron mass analyzer, a molecular fluorescence densitometer, a mini-tilty filter, and a lunar position sensor. This complement of instruments permitted the determination of the molecular nitrogen density and temperature in the altitude range from approximately 143 to 297 km over Wallops Island, Virginia, during January 1971. The MUMP 10 payload included an omegatron mass analyzer, an electron temperature probe (Spencer, Brace, and Carignan, 1962), a cryogenic densitometer, and a solar position sensor. This complement of instruments permitted the determination of the molecular nitrogen density and temperature and the charged particle density and temperature in the altitude range from approximately 145 to 290 km over Wallops Island, Virginia, during the afternoon preceding the MUMP 9 launch in January 1971. A general description of the payload kinematics, orientation analysis, and the technique for the reduction and analysis of the data is given. Author

N72-31876*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
THERMAL SUPPORT FOR SPACE SHUTTLE Interim Final Report
William G. Dean Jun. 1972 54 p refs
(Contract NAS8-25569)
(NASA-CR-123813; LMSC/HREC-D225916; HREC-5569-3) Avail: NTIS HC $4.75 CSCL 22B

The results are reported of research to provide thermal support in the design of the thermal protection system (TPS) of the space shuttles. Tasks discussed include: generation of temperature boundaries for space shuttle orbiter and booster during atmospheric reentry, leading edge and nose cap materials, TPS panel test facility support, thermal test facility support, and hot gas test facility support. A summary of thermal models generated for the space shuttle support is included. F.O.S.

N72-31877# European Space Vehicle Launcher Development Organization, Paris (France).
[BLUE STREAK SATELLITE LAUNCH VEHICLE]
K. J. Tullock, comp. Apr. 1972 46 p Revised
(HSD-TN-3230) Avail: NTIS HC $4.50

A revised booklet of facts and figures relating to the functioning of Blue Streak Satellite Launch Vehicle is presented. The book contains material on the F11 standard vehicle used to launch Europa 2 multistage vehicle from equatorial launch in French Guiana. Author

N72-31878*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: BATTERY SUBSYSTEM
J. Barry Trout Washington Sep. 1972 21 p
(NASA-TN-D-6976; MSC-S-333) Avail: NTIS HC $3.00 CSCL 10C

Experience with the Apollo command service module and lunar module batteries is discussed. Significant hardware development concepts and hardware test results are summarized, and the operational performance of batteries on the Apollo 7 to 13 missions is discussed in terms of performance data, mission constraints, and basic hardware design and capability. Also, the flight performance of the Apollo battery charger is discussed. Inflight data are presented. Author

N72-31879*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: FLIGHT PLANNING FOR MANNED SPACE OPERATIONS
John W. ONeill, J. B. Cotter, and T. W. Holloway Washington Sep. 1972 50 p
(NASA-TN-D-6973; MSC-S-319) Avail: NTIS HC $3.00 CSCL 22A

The history of flight planning for manned space missions is outlined, and descriptions and examples of the various evolutionary phases of flight data documents from Project Mercury to the Apollo Program are included. Emphasis is given to the Apollo flight plan. Time line format and content are discussed in relationship to the manner in which they are affected by the types of flight plans and various constraints. Author

N72-31880*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: PRESSURE VESSELS
Glenn M. Ecord Washington Sep. 1972 28 p refs
(NASA-TN-D-6975; MSC-S-327) Avail: NTIS HC $3.00 CSCL 13D

The Apollo spacecraft pressure vessels, associated problems and resolutions, and related experience in evaluating potential problem areas are discussed. Information is provided that can be used as a guideline in the establishment of baseline criteria for the design and use of lightweight pressure vessels. One of the first practical applications of the use of fracture-mechanics technology to protect against service failures was made on Apollo pressure vessels. Recommendations are made, based on Apollo experience, that are designed to reduce the incidence of failure in pressure-vessel operation and service. Author

N72-31881*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FUNDAMENTAL CONCEPTS OF STRUCTURAL LOADING AND LOAD RELIEF TECHNIQUES FOR THE SPACE SHUTTLE
R. S. Ryan, D. K. Mowery, and S. W. Winder 18 Aug. 1972 76 p refs
(NASA-TM-X-64684) Avail: NTIS HC $6.00 CSCL 22B

The prediction of flight loads and their potential reduction, using various control system logics for the space shuttle vehicles, is discussed. Some factors not found on previous launch vehicles that increase the complexity are large lifting surfaces, unsymmetrical structure, unsymmetrical aerodynamics, trajectory control system coupling, and large aeroelastic effects. These load-producing factors and load-reducing techniques are analyzed. Author

N72-31882*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRUMMAN H-33 SPACE SHUTTLE ORBITER AERODYNAMIC AND HANDLING-QUALITIES STUDY
Robert W. Rainey, George M. Ware, Richard W. Powell, Lawrence W. Brown, and David R. Stone Washington Sep. 1972 47 p refs
(NASA-TN-D-6948; L-8379) Avail: NTIS HC $3.00 CSCL 22B

A study of a representative delta-wing orbiter, the Grumman H-33, that utilized external-hydrogen tanks has been completed. The study encompassed a detailed wind-tunnel program from subsonic to hypersonic speeds, analyses of the data, and the calculation and assessment of the orbiter handling qualities using

the most aft center-of-gravity locations anticipated during entry and approach. Author

N72-31883*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DESIGN GUIDE FOR SPACE SHUTTLE LOW-COST PAYLOADS
30 Jun. 1971 166 p
(Contract NASw-2156)
(NASA-Cr-128048; LMSC-A990558) Avail: NTIS HC $10.50 CSCL 22B

A handbook is presented which delineates the principles of the new low-cost design methodology for designers of unmanned payloads to be carried by the space shuttle. The basic relationships between payload designs and program cost effects are discussed, and some concepts for designing low-cost payloads and implementing low-cost programs are given. The data are summarized from a payloads effects study of three unmanned earth satellites (OAO, a syneq orbiter, and a small research satellite), and the earth satellite design is emphasized. Brief summaries of space shuttle and space tug performance, environmental, and interface data pertinent to low-cost payload concepts are included. N.E.N.

N72-31884*# North American Rockwell Corp., Downey, Calif. Space Div.
FEEDLINE DYNAMIC EFFECTS ON SHUTTLE POGO STABILITY Final Report
O. D. DiMaggio and T. Nishimoto 5 May 1972 118 p refs
(Contract NAS1-10836)
(NASA-CR-112068; SD-72-SH-0039) Avail: NTIS HC $8.00 CSCL 22B

The transmission parameters for the dynamic characteristics of a feedline were approximated using both power and product series expansions. The feedline transfer functions of a shuttle orbiter feedline configuration were obtained using power and product series approximations of 60th, 120th, 180th, and 240th, order. Bode plots using the above polynomial approximations were obtained and the results compared with the exact solution. The exact solution to the feedline transfer function was obtained by using the transcendental terms appearing in the transmission parameters. The results show that the shuttle orbiter feedline may be modeled adequately by using polynomial approximations for the transcendental functions appearing in the transmission parameters. The power series approach was shown to be preferable to the product series method. Author

N72-31885*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEPARATION AND COMMUNICATIONS GEOMETRY ANALYSIS FOR A JUPITER ENTRY PROBE FROM A PIONEER SPACECRAFT
Edward L. Tindle Sep. 1972 31 p refs
(NASA-TM-X-62181) Avail: NTIS HC $3.75 CSCL 22B

The separation and communications geometry analysis is presented which shows that it is possible to target a Jupiter entry probe from a Pioneer spin-stabilized vehicle to desired entry conditions and maintain a continuous line-of-sight communications link while the probe descends to a pressure of 10 bars within the atmosphere. Such a targeting is possible with either the deflected probe mode or with the deflected bus mode. For the nominal mission studied, an 800 day trip in 1978 with the Pioneer type spacecraft flying by a 1.3 R(J), it was possible to achieve entries near zero angle of attack at about -25 deg relative entry flight path angle. Because of the constraint on the deflection maneuver for the deflected probe mode, the deflection and phasing velocity requirements are much larger for this mode. The geometry parameters, look angles, ranges and range rates, provided by this analysis permit the design of a functional communications system for the bus and probe. Avoiding a high trapped radiation belt hazard at Jupiter by flying the bus by at 6 R(J), however, requires using a despun antenna on the flyby bus. Author

N72-31886# European Space Research and Technology Center, Noordwijk (Netherlands).
ESRO 1 SPACECRAFT DESCRIPTION DOCUMENT
J. Plevin, ed., M. Short, ed., F. Lajeunesse, ed., C. F. VanMansvelt, ed., and H. Schneiter, ed. May 1972 357 p refs Prepared in cooperation with Lab. Central de Telecommun., Contraves AG, and Bell Telephone Mfg. Co., Antwerp
(ESRO-TR-10-ESTEC) Avail: NTIS HC $20.00

The mission and objectives of the ESRO 1 program are discussed, and a history of the project is given, as well as the project management and the methods for achieving the program aims. The problems encountered in the ESRO 1 spacecraft development phase and the solutions adopted are dealt with. Two successful launches were completed, one in October 1968 and one in October 1969. For individual titles, see N72-31887 through N72-31901.

N72-31887 European Space Research and Technology Center, Noordwijk (Netherlands).
THE ESRO-1 PROGRAMME
D. E. Mullinger and M. G. Grensemann *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 1-19 (For availability see N72-31886 22-31)

The missions and objectives of the ESRO 1 program are described, and the main events leading to two successful launches are summarized. The main characteristics as well as the main contractors of the satellite are listed. Management techniques and methods applied in carrying out the program are discussed, including cost control. ESRO

N72-31888 Contraves Corp., Zurich (Switzerland).
THE EVOLUTION OF THE DESIGN
C. F. VanMansvelt and M. Short *In* ESRTC ESRO 1 Spacecraft Description Doc. May 1972 p 21-30 refs (For availability see N72-31886 22-31)

The design of the polar ionospheric satellite ESRO 1 is reviewed. Requirements are compared with a description of the successful design, showing how conflicts between requirements were solved. Design and development phases are analyzed, and technical aspects of the orbit are discussed. ESRO

N72-31889 European Space Research and Technology Center, Noordwijk (Netherlands).
THE SCIENTIFIC EXPERIMENTS
R. Jaeschke *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 31-51 (For availability see N72-31886 22-31)

The eight experiments aboard the ESRO 1 satellite to study the polar ionosphere and aurorae are described. Scientific objectives, measurement techniques, constraints, and ground checkout are discussed. ESRO

N72-31890 Contraves Corp., Zurich (Switzerland).
STRUCTURE AND MECHANICAL SYSTEMS
H. Schneiter and A. Veit *In* ESRTC ESRO 1 Spacecraft Description Doc. May 1972 p 53-99 (For availability see N72-31886 22-31)

The design and development of the ESRO 1 satellite structure and mechanical system are discussed. The project phase of nearly four years is reviewed, and the method of meeting the requirements and solving the technical problems is described. Examples are given of design modifications and refinements as a result of new requirements or structural testing. It is shown because of the inherent flexibility of the original structural layout, none of the modifications introduced had an influence on the basic structure conception. ESRO

N72-31891 European Space Research and Technology Center, Noordwijk (Netherlands).
THE POWER SUPPLY SYSTEM
F Vanlngen *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 101-122 refs (For availability see N72-31886 22-31)

Design and development of the ESRO 1 satellite power supply system are reviewed. The evolution of the system through the technical proposal phase, the design phase, and the manufacturing phase at the beginning of which the final design was evolved is discussed. The extensive test program carried out during the different phases is described. A block diagram of the final design is given which shows all the subsystems and the power distribution lines. The reliability of the system is discussed. ESRO

N72-31892 European Space Research and Technology Center, Noordwijk (Netherlands).
TELECOMMUNICATIONS SYSTEM
J. Plevin and M. J. Garvin *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 123-157 refs (For availability see N72-31886 22-31)

The ESRO 1 satellite telecommunication systems are described. Information is provided on the initial design requirements, as well as the reasons for adopting a particular design. A short history of the development and testing phases is included which indicates those areas where modifications were found necessary. A block schematic diagram of the telecommunications system in its final layout is given. Telemetry equipment, telecommand equipment, and subsystem test equipment are also reviewed. ESRO

N72-31893 Laboratoire Central de Telecommunications, Paris (France).
ONBOARD INSTRUMENTATION (HOUSEKEEPING)
F. Chenon, H. Euzen, and S. Zymanski *In* ESRTC ESRO 1 Spacecraft Description Doc. May 1972 p 159-176 refs (For availability see N72-31886 22-31)

The evolution of the design of the ESRO 1 satellite housekeeping package is reviewed from the initial tender offer to the design of the flight unit. The various units manufactured, the corresponding technology used, and the individual circuits are described. The operating principles and main performance parameters of these circuits are given, along with information on the components used and the specifications for component qualification. The specific test equipment used in the bench testing and integration of the housekeeping package is described. A block diagram showing the housekeeping functions in relation to the overall spacecraft system is included. ESRO

N72-31894 European Space Research and Technology Center, Noordwijk (Netherlands).
ATTITUDE STABILIZATION
R. Kammueller and F. Haenni (Contraves AG) *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 177-207 refs (For availability see N72-31886 22-31)

Design requirements for the ESRO 1 satellite attitude stabilization are reviewed. Perturbation acting on the satellite is discussed, and the final layout to meet the requirements is described. Dynamic simulation of the satellite attitude behavior with three degrees of freedom in rotation was performed. The analog program includes the elliptic polar orbit of the satellite around the rotating earth. The geomagnetic field was simulated by an inclined magnetic dipole. Results of analog and digital simulation which lead to the optimization of the spin control system are given. ESRO

N72-31895 European Space Research and Technology Center, Noordwijk (Netherlands).
ATTITUDE MEASUREMENT SYSTEM
C. C. Kalweit *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 209-240 refs (For availability see N72-31886 22-31)

The design of the ESRO 1 satellite attitude measurement system is discussed. Measurements are made on the geomagnetic vector and on the solar vector over the sunlit part of the orbit by two sun sensors and four magnetometer sensors. The redundancy allows for an in-flight sensor correction. Performance of these sensors is discussed. Tests carried out as part of the environmental and performance test program are analyzed. A technique was developed to perform magnetic tests on the spacecraft although no controlled magnetic test field existed in the vicinity of the main test stations. ESRO

N72-31896 European Space Research and Technology Center, Noordwijk (Netherlands).
THE PYROTECHNIC SYSTEM
F. Vanlngen *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 241-255 refs (For availability see N72-31886 22-31)

The ESRO 1 satellite pyrotechnic system to release the yo-yo masses and deploy the experiment booms at a predetermined time after separation from the fourth stage of the launcher is described. Functional requirements are listed and the design history reviewed. The final design is described, and safety devices for accident prevention and environmental tests are discussed. ESRO

N72-31897 European Space Research and Technology Center, Noordwijk (Netherlands).
THERMAL CONTROL
O. Ullmann *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 257-276 refs (For availability see N72-31886 22-31)

The design of the ESRO 1 satellite thermal control is discussed, and boundary conditions imposed by specifications are analyzed. The main thermal control activities and events are reviewed. It is shown that a careful search for the optimum solution within the boundary conditions and an improved prediction accuracy lead to a satisfactory solution. The evolution of the mathematical model from an initial 24 mode model to a 93 mode model is discussed. The adjusted model was used to calculate the in-orbit temperature for eight different orbits and attitude modes. ESRO

N72-31898 Laboratoire Central de Telecommunications, Paris (France).
INTEGRATION
F. Lajeunesse and P. Savornin *In* ESRTC ESRO 1 Spacecraft Description Doc. May 1972 p 277-290 (For availability see N72-31886 22-31)

The integration of the ESRO 1 satellite is reviewed, and the various satellite models that were built are listed. Design construction of the wiring harnesses is discussed. The integration of hardware in the prototype and in the flight units is also discussed. The main problems encountered during the integration and test phases are analyzed, including high voltage breakdown problems, interference to telecommand receiver operation, telemetry interference on scientific experiments, electrical interference between the power supply and the experiments, and safety problems with the test equipment. ESRO

N72-31899 European Space Research and Technology Center, Noordwijk (Netherlands).
ELECTRICAL GROUND SUPPORT EQUIPMENT
J. Plevin, C. Chauvineau (Lab. Central de Telecommun.), A. Michael, M. Short, and V. Chaptal (Lab. Central de Telecommun.) *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 291-310 refs (For availability see N72-31886 22-31)

The electrical ground support checkout equipment used for testing the ESRO 1 satellite is described. It includes two trailer mounted checkout stations and the housekeeping checkout console. For each of these units, the design aim is reviewed, and their uses while performing prelaunch checks on the satellite are discussed. ESRO

N72-31900 European Space Research and Technology Center, Noordwijk (Netherlands).
SPACECRAFT TEST EQUIPMENT
M. Short, A. Ruggaber (Contraves AG), and H. Schultz (Contraves AG) *In its* ESRO 1 Spacecraft Description Doc. May 1972 p 311-332 refs (For availability see N72-31886 22-31)

Some of the more specialized items of test equipment used for the ESRO 1 satellite checkout are described. They include the degassing coil, the magnetic stabilization unit, the spin test unit, and the static and dynamic balance unit. Design and development of these units and measuring techniques are analyzed. ESRO

N72-31901 Contraves Corp., Zurich (Switzerland).
HANDLING AND TRANSPORT EQUIPMENTS
H. Schneiter *In* ESRTC ESRO 1 Spacecraft Description Doc. May 1972 p 333-345 (For availability see N72-31886 22-31)

The handling and transport equipment designed for the ESRO 1 satellite is described. The principal requirement for the handling equipment was maximum accessibility to the satellite subsystems during integration, checkout, and testing. In conjunction with this, a set of accessories was developed to enable safe crane maneuvers. Great care was taken to ensure minimum interference with the satellite magnetic stabilization system. ESRO

N72-31902# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
AN ANALYSIS OF THE STABILITY OF THIN LIQUID FILMS IN HYPERSONIC ENVIRONMENTS
John Starkenberg Apr. 1972 43 p refs
(Contract DAH04-69-C-0077; ARPA Order 1442)
(AD-742817; PIBAL-72-11) Avail: NTIS CSCL 16/3

The stability of thin liquid cooling films adjacent to high speed gas flows has been examined to determine its effect on the coolant requirements of hypersonic vehicles. The analysis is also applicable to surface films in high energy exhaust flows. Classical hydrodynamic stability theory was applied to the liquid film with boundary conditions corresponding to both supersonic and subsonic external streams. Instability mechanisms which coupled the disturbance motion of the gas to the disturbance motion of the liquid were of primary interest and those involving energy transfer from the basic flow were specifically excluded. Numerical solutions as well as exact and approximate analytical solutions were developed. GRA

N72-31903# Harry Diamond Labs., Washington, D.C.
CONTROL OF ELECTRON DENSITY DISTRIBUTION ON HYPERSONIC VEHICLES
Irvin Pollin Apr. 1972 99 p refs
(DA Proj. 1T0-61101-A-91)
(AD-743183; HDL-TR-1592) Avail: NTIS CSCL 16/2

Non-ablating conical and ogival hypersonic vehicles having sharply pointed noses are assumed so that all electrons are produced by aerodynamic heating of clean air in a turbulent boundary layer. The ion and electron conservation equations are solved exactly at every point in the boundary layer in a non-equilibrium ionization flow. The electron diffusion and the resulting electron distribution are shown to be very sensitive to electric fields applied at the conducting surface of the vehicle. The applied electric field is shown to result in changes of the maximum electron density by more than two orders of magnitude. The detailed calculations of the ion and electron distributions and the applied electric power requirements are presented for a vehicle consisting of a conical nose with a semivertex angle of 10 deg at Mach numbers 10 and 15 at sea level. Author (GRA)

N72-31904# Naval Postgraduate School, Monterey, Calif.
TRANSVERSE JETS FOR CONTROL OF MISSILE STEERING THRUSTORS
Robert H. Nunn 10 Apr. 1972 49 p refs
(AD-742924; NPS-59NN72041A) Avail: NTIS CSCL 13/7

Following a brief comparison of pulse-duration-modulation and proportional systems, a detailed program of analysis and experimentation is described in which thrustors throttled by high velocity transverse jets are evaluated. For a gas jet injected normal to the flow at the throat of a sonic nozzle, an analytical model was developed that gives excellent agreement with experimental observations. Experimental studies were conducted for a variety of jet and mainstream conditions and utilizing quantitative and qualitative techniques to describe the jet/mainstream interaction. Within the range of the test results, insufficient mainstream throttling is attainable to warrant the use of the method as a proportional control device for missile steering thrustors. Author (GRA)

N72-31905# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THEORETICAL STUDY OF SOLAR RADIATION EFFECTS ON THE PAGEOS SATELLITE M.S. Thesis
William B. Patterson Mar. 1972 79 p refs
(AD-743618; GA/PH/72-1) Avail: NTIS CSCL 22/3

Observation of Pageos, a 100 ft. diameter balloon satellite, indicates that driving torques must be acting on the body to cause the dynamic motions. This theoretical study tests one explanation of these torques. The proposed explanation is that solar radiation would heat the rotating satellite unevenly causing distortions in the surface. Momentum exchange between solar photons and the distorted surface would then generate the required torques. A spherical model of Pageos was found adequate to explain the torque causing rotation but totally inadequate to explain the precession torque. An oblate spheroid, which is the time averaged model of the actual shape, was then used and proved to be very successful in predicting the precession torque. Author (GRA)

N72-31906# Aerospace Corp., San Bernardino, Calif. Technology Div.
EFFECT OF A LIFT VARIATION ON THE IMPACT OF A ROLLING REENTRY VEHICLE Report for Jun. - Sep. 1971
J. P. Crenshaw 30 Dec. 1971 19 p refs
(Contract F04701-71-C-0172)
(AD-743890; TR-0172(S2816-16)-3; SAMSO-TR-72-60) Avail: NTIS CSCL 16/3

An analytical description of the effect of roll rate variation on reentry vehicle impact has been extended to include the effect of step changes in trim angle of attack. Simple analytical descriptions of the effect of step change in trim at a constant roll rate and in combination with a step change in roll rate are presented also. Results obtained using these expressions are compared with those obtained from six-degree-of-freedom trajectory simulations of the same cases. Author (GRA)

N72-31907# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SPACE-TIME MISSILE ENVELOPES
Louis A. Tamburino Feb. 1972 24 p refs
(AF Proj. 7114)
(AD-742991; ARL-72-0054) Avail: NTIS CSCL 16/4

The paper is concerned with improving the logical decision process in one-to-one encounters between bombers and interceptors. It presents a new approach to the problem of making fast predictions based on the use of missile space-time envelopes, which characterize more generally the extent of a missile's capability by combining geometrically the spatial and temporal aspects of the prediction problem. Empirical means of finding these envelopes are discussed, as well as the physical significance of this scheme for summarizing the results of simulation experiments. It has been shown that space-time envelopes can be used to make definite miss predictions; this feature has a useful potential as an indicator for evasive maneuvers. Author (GRA)

N72-31908# ARO, Inc., Arnold Air Force Station, Tenn.
ABORT SEPARATION PRESSURE DISTRIBUTIONS ON MCDONNELL-DOUGLAS SPACE SHUTTLE CONFIGURATIONS AT MACH NUMBERS 2, 3, AND 5 Final Report
W. T. Strike, Jr. AEDC May 1972 79 p refs
(Contract F40600-72-C-0003; ARO Proj. VA1163)
(AD-742995; ARO-VKF-TR-71-247; AEDC-TR-72-46) Avail: NTIS CSCL 22/2

The report summarizes the pressure distributions obtained on the lower surface of an orbiter and upper surface of a booster (adjacent model surfaces) during possible staging and abort maneuvering positions, and for various proposed launch configurations, of a space shuttle vehicle. The results were obtained with and without booster and orbiter plume simulation at nominal free-stream Mach numbers of 2, 3, and 5. A brief description is made of the calibration of nozzles used to generate plumes for the power-on simulation. Results demonstrate the importance of plume simulation on the aerodynamic loading of a vehicle and suggest that plume simulation is needed to evaluate properly the aerodynamic coefficients for space shuttle vehicles.
Author (GRA)

N72-31909# Air Force Academy, Colo. Frank J. Seiler Research Lab.
A METHOD FOR AERODYNAMIC AND PROPULSION DESIGN OPTIMIZATION OF THE SHORT RANGE DOGFIGHT MISSILE Final Report
Carl A. Forbrich, Roger W. Gallington, John E. Hatlelid, John Paul Hyde, and Richard C. Murrow May 1972 24 p refs
(AF Proj. 7904)
(AD-742998; SRL-TR-70-0009) Avail: NTIS CSCL 16/4

The purpose of this study was to develop a computer program by which to optimize the various missile parameters available to the missile designer of a short range (one to ten mile radius) missile. The missile model used in this study was required to have the capability of intercepting a target with an unspecified heading at an initial range of three miles, and an angle-off-boresight of 45 deg. The missile intercepts the target by flying a hard-over turn initially, followed by a straight-line trajectory until impact. This study demonstrates the feasibility of using a computer model, similar to the one in this paper, to check out the capabilities claimed by contractors for their missile designs.
GRA

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-31910 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON SIMPLIFIED THEORIES OF CYCLIC PLASTICITY
Z. Mroz and N. C. Lind Jun. 1972 24 p refs
(Rept-20) Avail: Issuing Activity

Simple models of cyclic behavior are considered that could be expressed in terms of generalized stresses and strains and applied in treating boundary value problems for beams, plates, or shells. Introducing the concept of infinite number of piecewise-linear loading surfaces, analytical expressions were obtained for stress-stain relations in several subdomains of the stress space, both for loading and unloading, or subsequent loading conditions. The stress-strain relations obtained imply partial independence of the loading path. This concept was elaborated for particular loading conditions: proportionately alternating loads, cyclic loads superposed upon fixed loading, etc. Some particular cases of beams are considered in detail in order to illustrate applicability of the proposed description.
Author

N72-31911# National Aerospace Lab., Amsterdam (Netherlands).
SOME ELEMENTARY CALCULATIONS ON SECONDARY BENDING IN SIMPLE LAP JOINTS
J. Schijve 27 Mar. 1972 13 p refs
(NLR-TR-72036-U) Avail: NTIS HC $3.00

Formulas for calculating the permanent bending deformations of lap joints that result from tension loads are given. Calculations indicate that the effect of the clamping conditions on the secondary bending will generally be small. On the other hand, permanent bending deformation at the overlap will have a significant effect on the secondary bending.
Author

N72-31912# Technische Hogeschool, Delft (Netherlands). Lab. Voor Technische Mechanica.
ON THE POSTBUCKLING BEHAVIOUR OF THE CYLINDRICAL SHELL
Stanislaw Lukasiewicz May 1972 29 p refs
(WTHD-38) Avail: NTIS HC $3.50

The problem of the postbuckling behavior of an axially compressed, thin walled cylinder is considered. It follows from theoretical considerations that the postbuckling equilibrium position can be represented by a single load deflection curve and that the minimum load can be expressed by the formula p = p cap E h/R, where p cap is a constant coefficient. The results obtained by means of the geometrical method are in agreement with the behavior of the shell observed during experiments.
Author

N72-31913# Technion - Israel Inst. of Tech., Haifa.
AN ELLIPTICAL CRACK SUBJECTED TO AN IMPULSIVE LOAD APPLIED TO ITS BOUNDARY Dept. of Aeronautical Engineering.
M. Ziv Feb. 1971 20 p refs
(TAE-148) Avail: NTIS HC $3.00

A boundary value problem in which a crack is subjected to an impulsive load was solved. The crack considered is an elliptic cylindrical cavity in an infinite solid. The applied load is an impulsive step function of the Heaviside type and is distributed uniformly over the entire cavity. The solid is made of an ideal elastic material. Critical values of the stress distribution were calculated by the characteristics method to determine the decay of the generated wave.
Author

N72-31914# National Aerospace Lab., Tokyo (Japan).
LARGE DEFLECTION OF CANTILEVER BEAMS
Yasuo Tada and Kazuo Kusaka 1971 28 p refs In JAPANESE; ENGLISH summary
(NAL-TR-250) Avail: NTIS HC $3.50

Finite element solution procedures are developed for the analysis of inextensible beam. For this approach, nodal coordinates and direction cosines of a tangent vector in the deformed configuration were adopted as nodal parameters. Element stiffness matrices are obtained from the nonliner equations of equilibrium using Galerkin's method. In the numerical solution procedure, an iterative process must be applied using two alternative stiffness equations to ensure the convergence of solutions. The results of a numerical calculation using this method compare reasonably well with those of experiment, as well as those obtained using the elliptical integral.
Author

N72-31915# National Aerospace Lab., Tokyo (Japan).
THE EXPERIMENTS ON THE BUCKLING OF CIRCULAR CYLINDRICAL SHELLS
Susumu Toda and Kazuo Kusaka 1972 17 p refs In JAPANESE; ENGLISH summary
(NAL-TR-270) Avail: NTIS HC $3.00

Experimental results on the buckling of brass and Mylar cylindrical shells having radius-to-thickness ratio of 315 under combined axial compression and torsion are presented and compared with the values obtained from three interaction formulae conventionally used. Attention is also devoted to the postbuckling pattern and wave number of the specimen. Experimental results are presented for the plastic buckling of aluminum cylinders with a circular cutout. An empirical formula to predict the ultimate compressive load of cylinder with a cutout as well as plastic buckling stress of complete cylinder derived from the deformation theory on the assumption of power low of stress-strain relation is proposed.
Author

N72-31916# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONLINEAR NATURAL VIBRATIONS OF RECTANGULAR PLATES AND CYLINDRICAL PANELS
A. S. Volmir, A. A. Logvinskala, and V. V. Rogalevich 1972 3 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 205, no. 2, 1972 p 300-302
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The numerical analysis of nonlinear vibrations of plates and shells by reducing the structure to a system with one or two degrees of freedom is discussed. The initial differential equations were integrated in both time and space coordinates. It was assumed that the vibrations are harmonic. The solution is obtained for freely supported plates and panels in a third approximation in the space coordinates, and the integration of the system of ordinary differential equations with respect to the time is performed by the Runge-Kutta method. Author

N72-31917*# Scientific Translation Service, Santa Barbara, Calif.
SELECTION OF THE OPTIMAL CONFIGURATION OF CROSS SECTIONS
Yu. M. Pochtman Washington NASA Aug. 1972 7 p refs Transl. into ENGLISH from Mashinostr. (Kiev), no. 2, 1972 p 9-11
(Contract NASw-2035)
(NASA-TT-F-14539) Avail: NTIS HC $3.00 CSCL 20K

The problem of selecting the optimum (with respect to area) cross sections of rectangular beams in oblique bending is formulated as a nonlinear programming problem where the objective function is the cross section area and the constraints are the strength and stability conditions for the plane bending mode. A solution is obtained by the method of random search with a director cone. The algorithm of the method is constructed on the basis of a learning algorithm. Author

N72-31918*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROPAGATION OF THE TRANSVERSE NORMAL STRESS IN A THICK PLATE DUE TO DISTRIBUTED LATERAL IMPULSIVE LOADINGS
Larry W. Oline Washington Sep. 1972 35 p refs
(NASA-TM-X-2568; L-8043) Avail: NTIS HC $3.00 CSCL 20K

A theoretical study of the elastic stresses produced in an infinite plate when struck by a high-speed object is presented. The solution is obtained by means of linear elasticity. Laplace transformation techniques are employed to solve the axisymmetric problem. The plate is loaded normal to its surface with a uniform load over a circular area. The normal stress at the wave front of the unreflected dilatation wave along the axis and its variation with the radius of loading are determined. Various facets of the problem are discussed. Author

N72-31919*# KMS Technology Center, Van Nuys, Calif.
DYNAMIC RESPONSE OF NONUNIFORM STRUCTURES TO CLASSES OF PRESSURE FIELDS Final Report, 23 Jun. 1970 - 23 Apr. 1971
Milt G. Cottis Oct. 1971 170 p refs
(Contract NAS5-21516)
(NASA-CR-122477) Avail: NTIS HC $10.50 CSCL 20K

A semi-analytical method is developed for the calculation of the response of nonuniform structures to deterministic and random excitation. The method is based on parametric representations of the impulse response and input functions. With these representations, a class of structures of specified geometry and a class of pressure fields of practical concern can be considered simultaneously in a single analytical calculation of structural response. In engineering applications, the parameters in the impulse response function can be fixed once the numerical solution of the associated eigenvalue problem is available; the input function parameters can be specified given a particular input function or pressure field data. This methodology is applied to nonuniform beams and circular cylindrical shells for which parametric response solutions are derived. The computerized version of these solutions is also presented. Author

N72-31920*# Michigan Univ., Ann Arbor.
TIME-DEPENDENT EDGE NOTCH SENSITIVITY OF INCONEL 718 SHEET IN THE TEMPERATURE RANGE 900 TO 1400 F (482 TO 760 C)
David J. Wilson Apr. 1972 98 p refs
(Grant NGL-23-005-005)
(NASA-CR-124628; Rept-043680-18-T) Avail: NTIS HC $7.00 CSCL 20K

Time-dependent notch sensitivity of Inconel 718 sheet occurred at 900 to 1200 F when notched specimens were loaded below the yield strength, and tests on smooth specimens showed that small amounts of creep consumed large fractions of creep-rupture life. The severity of the notch sensitivity decreased with decreasing solution treatment temperature and increasing time and/or temperature of the aging treatment. Elimination of the notch sensitivity was correlated with a change in the dislocation mechanism from shearing to by-passing precipitate particles. Author

N72-31921# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
STRESS CONCENTRATION AROUND CURVILINEAR HOLES IN SPHERICAL SHELLS
Prem Prakash and K. P. Rao Jun. 1972 64 p refs
(AE-314S) Avail: NTIS HC $5.25

An analysis is presented for the determination of stresses around unreinforced, as well as reinforced, arbitrarily shaped, curvilinear holes in thin, shallow, spherical shells under internal pressure. Semimonocoque structures have found extensive use in aircrafts, rockets, missiles, nuclear power plants, pressure vessels, petrochemicals and several other industries. Starting from the governing differential equations for thin, shallow, spherical shells, the solution was first obtained for a circular hole. The solution for any arbitrarily shaped curvilinear hole was then obtained using the circular hole solution and employing a conformal mapping technique. This requires the choice of a suitable transformation function which maps conformally the given arbitrarily shaped contour into a circle. The method of solution involves a first order approximation over the circular hole solution. The results presented account for sufficiently large size openings not available in existing literature. Author

N72-31922# Technische Univ., Berlin (West Germany).
VISCOELASTIC INCOMPRESSIBLE ISOTROPIC MATERIALS: APPROXIMATION AND APPLICATION OF THE GENERAL MATERIAL EQUATION Ph.D. Thesis [VISKOELASTIZITAT INKOMPRESSIBLE ISOTROPER STOFFE: APPROXIMATION DER ALLGEMEINEN MATERIALSLEICHUNG UND ANWENDUNGEN]
Peter H. Haupt 1971 149 p refs In GERMAN
Avail: NTIS HC $9.50

An equation for finite linear viscoelasticity containing 11 functions is used to analyze small and slow deformations in incompressible isotropic materials. The omission of third order values gives simplified approximations for an integral representation with two material constants and two material functions, and a differential type representation with 4 material constants. Both methods can be used either as approximations for general material behavior in special deformations or as definition equations for ideal materials. Transl. by G.G.

N72-31923# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Plastiques.
THEORETICAL AND EXPERIMENTAL STUDY OF THE TECHNICAL CONSTANTS OF LAMINATES
Baudouin Lacrosse, Charles Massonnet (Liege Univ.), Georges Viatour, and Fernand Vidouse Jun. 1972 110 p refs Sponsored by Inst. pour l'Encouragement de la Rech. Sci. dans

l'Ind. et l'Agr. (IRSIA)
(CRIF-PL-3) Avail: NTIS HC $7.50

The theory governing anisotropic materials is reviewed. Different theories for the calculation of the technical constants of laminates from the characteristics of their components are compared with the experimental results obtained for various laminates. Laminates reinforced with mats, equilibrated fabrics, etc., and with different types of resins were considered. ESRO

N72-31924# Liege Univ. (Belgium). Lab. d'Essais des Constructions du Genie Civil et d'Hydraulique Fluviale.
COMPUTATION OF ISOSCELES FILLET WELDED JOINTS WITH STATIC LOADING USING THE MAXIMUM SHEARING CRITERION. PART 1: THEORETICAL CONSIDERATIONS [LE CALCUL DES CORDONS D'ANGLES RECTANGLES ISOCELES SOLLICITES STATIQUEMENT PAR LE CRITERE DE CISAILLEMENT MAXIMUM. 1ERE PARTIE: CONSIDERATIONS THEORIQUES]
Willy Chapeau, Pierre Guiaux, and Jean-Claude Lambert (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Jun. 1972 53 p refs In FRENCH Sponsored by IRSIA
(CRIF-MT-77-PT-1) Avail: NTIS HC $4.75

A rupture strength method based on the Tresca criterium is presented, which permits evaluation of the rupture strength of welded joints from rupture stress in fillets of a standard test slab. The generalization of the formula for computation of isosceles fillet-welded joints presents certain difficulties which led to the adoption of K and lambda values, leading to safety factors higher than those adopted for the parent metal. Moreover these difficulties are increased when dealing with high elastic limit steels and aluminum alloys, since the formula takes no account of welding process, thermal regime, shape and surface finishing of the fillet, stiffness of assembled parts, and penetration. ESRO

N72-31925# Institut Franco-Allemand de Recherches, St. Louis (France).
THE BEHAVIOR OF CURVED RESIN CONCRETE PLATES PART 1: ORIENTATING INVESTIGATION IN THE SHOCK TUBE [TENUE AU SOUFFLE DE DALLES BOMBEES EN BETON DE RESINE. PREMIERE PARTIE: ETUDE D'ORIENTATION EFFECTUEE AU TUBE A CHOC]
G. Meyer and G. Mosser 22 Jun. 1971 104 p In FRENCH
(Contract DTEN-70.70.198)
(ISL-13/71-Pt-1) Avail: NTIS

The dynamic response of curved shells under the effect of a stepped wave generated by a shock tube was investigated using small sized concrete resin models (336 mm diameter, 15 mm thickness). It is shown that, for equal mass, the quality of resistance is a function of the plate curvature. The thinning of the shell at its center and reinforcement at the edges do not increase its resistance to blasts. It is concluded that better support condition can be achieved with plates than with shells.
ESRO

N72-31926# Institut Franco-Allemand de Recherches, St. Louis (France).
SQUARE, THIN, SUPPORTED OR CLAMPED PLATES: STATIC INVESTIGATIONS AT UNIFORM PRESSURE AND DYNAMIC INVESTIGATIONS (STEP INCREASE) [PLAQUES CARREES, MINCES, APPUYEES OU ENCASTREES: ETUDE STATIQUE (PRESSION UNIFORME) ET ETUDE DYNAMIQUE (ONDE EN ECHELON)]
M. Schaffar 3 Sep. 1971 68 p refs In FRENCH
(Contract DTEN-71.70.185)
(ISL-23/71) Avail: NTIS HC $5.50

The static and dynamic response of square, thin, supported, and clamped plates was analyzed using the static and dynamic Timoshenko methods and a finite difference method. The Timoshenko method is more suitable than the finite difference method when applied to static response. However both methods agree for the analysis of dynamic response. The dynamic amplification coefficient is 2.1 for sag and 2.5 for deformation in the case of the clamped support but 2.0 for sag and 2.2 for deformation in the case of the unclamped support. ESRO

N72-31927# Institut Franco-Allemand de Recherches, St. Louis (France).
GENERATION AND MEASUREMENT OF VERY SHORT SHOCK WAVES IN SOLIDS [GENERATION ET MESURE D'ONDES DE CHOC TRES BREVES DANS LES SOLIDES]
M. Samirant and A. Lichtenberger 1 Mar. 1972 29 p refs In FRENCH
(Contract DTEN-71.70.185)
(ISL-9/72) Avail: NTIS HC $3.50

The dynamic response of porous and composite materials subjected to low intensity plane shock was investigated. Different shock generators are described as well as ways to measure shocks at impact of either flexible explosive mechanically projected thin aluminum and polyethylene foil or light gas gun projectiles. Pressure and velocity of projectiles at impact were measured using piezoelectric transducers to establish the dynamic characteristics of the samples. ESRO

N72-31928# Alabama Univ. Research Inst., Huntsville.
ENERGY CRITERIA FOR STABILITY OF STRUCTURES
Gerald Wempner Apr. 1972 33 p refs
(Contract F44620-69-C-0124; AF Proj. 9560; Proj. Themis)
(AD-743012; UARI-RR-119; AFOSR-72-0875TR) Avail: NTIS CSCL 13/13

The energy criteria of Trefftz and Koiter, for the critical load upon an elastic system and for the stability of the system at the critical load, are presented. The presentation employs geometrical interpretations and simple examples to exhibit the essential features of the criteria and the related behavior of the structural system. Author (GRA)

N72-31929# Alabama Univ. Research Inst., Huntsville.
USERS' MANUAL FOR DIGITAL COMPUTER PROGRAM OK1. NUMERICAL ANALYSIS OF FINITE AXISYMMETRIC DEFORMATIONS OF INCOMPRESSIBLE ELASTIC SOLIDS OF REVOLUTION
J. E. Key Apr. 1972 120 p refs
(Contract F44620-69-C-0124; AF Proj. 9560; Proj. Themis)
(AD-743013; UARI-RR-121; AFOSR-72-0818TR) Avail: NTIS CSCL 20/11

The document describes a general purpose computer program for the analysis of finite axisymmetric deformations of incompressible isotropic bodies of revolution. It employs the finite element method and uses incremental loading techniques to solve nonlinear equations generated in the analysis.
Author (GRA)

N72-31930# Alabama Univ. Research Inst., Huntsville. Research Inst.
A THEORY OF THERMO-PLASTIC MATERIALS WITH MEMORY
J. T. Oden and D. R. Bhandari Apr. 1972 37 p refs
(Contract F44620-69-C-0124; AF Proj. 9560; Proj. Themis)
(AD-743011; UARI-118; AFOSR-72-0904TR) Avail: NTIS CSCL 20/11

A theory of thermoplastically simple materials with memory is developed. The response functionals are assumed to depend on the histories of the strain tensor gamma, inelastic strain tensor eta, temperature theta and the current value of the temperature gradient g. Thermodynamical restrictions on the forms of the constitutive equations are explored and it is shown that the stress tensor and specific entropy are derivable from the free energy functional which is independent of temperature gradient. It is also shown that the internal dissipation can be computed directly from the free energy and the constitutive equation for the inelastic strain rate. Under additional restrictions, special forms of the constitutive equations are developed, and furthermore the present theory does make use of the idea of so called yield surface. Author (GRA)

N72-31931# Alabama Univ. Research Inst., Huntsville. Research Inst.
THEORY OF CONJUGATE PROJECTIONS IN FINITE ELEMENT ANALYSIS
J. T. Oden Apr. 1972 50 p refs
(Contract F44620-69-C-0124; AF Proj. 9560)
(AD-743010; UARI-117; AFOSR-72-0905TR) Avail: NTIS CSCL 20/11

The lecture is devoted to a discussion of the theory of conjugate subspaces, conjugate projections and conjugate approximation functions in the finite element analysis of boundary value problems in mathematical physics. Special emphasis is given to applications in linear elasticity and the linear theory of structures. Examples of higher order conjugate finite element approximations are given and the concept of consistent stress approximations in finite element models based on assumed displacement fields is presented. Author (GRA)

N72-31932# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NONLINEAR VIBRATIONS OF MEMBRANES UNDER RANDOM INFLUENCES
V. A. Ivovich 3 Mar. 1972 19 p refs Transl. into ENGLISH from Issled. po Teorii Sooruzhenii. Sb. Statei (USSR), no. 17, 1969 p 163-171
(AD-742801; FTD-MT-24-1600-71) Avail: NTIS CSCL 20/11

Nonlinear transverse vibrations of a plane rectangular membrane are examined for random steady state effects. The perturbational effect is assumed to be delta correlational in time (white noise). The fundamental equations are compared with the Foeppel-Karman theory. Transverse displacement is represented in the form of a double trigonometric series, each member of which is expressed by the product of a generalized coordinate for the shape of the natural frequencies of the corresponding linear problem. Nonlinear equations in terms of generalized coordinates are obtained by Bubnov-Galerkin method. The solution to these equations was arrived at by using the Fokker-Planck-Kolmogorov equations. Author (GRA)

N72-31933# Alabama Univ., Huntsville. Div. of Graduate Programs and Research.
BASIC RESEARCH IN METHODS OF APPROXIMATION IN THE NONLINEAR MECHANICS OF SOLIDS AND STRUCTURES Annual Report, 1 Jan. 1971 - 1 Jan. 1972
J. Tinsley Oden Jan. 1972 96 p refs
(Contract F44620-69-C-0124; AF Proj. 9560; Proj. Themis)
(AD-743278; AFOSR-72-0789TR) Avail: NTIS CSCL 20/11

The report summarizes work completed and work in progress on a project aimed at developing general approximate methods for a wide range of nonlinear problems in solid and continuum mechanics. Work is reported in the following areas: Theories of nonlinear structural behavior; Approximation theory; Computational methods; Applications, such as nonlinear solid mechanics and structural dynamics; and, Computer programs.
GRA

N72-31934# Army Foreign Science and Technology Center, Charlottesville, Va.
DISTRIBUTION OF WAVES IN A LAMINATED VISCOELASTIC MEDIUM
A. M. Shvidanenko 29 Oct. 1971 9 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 11, 1969 p 124-127
(AD-742892; FSTC-HT-23-375-71) Avail: NTIS CSCL 20/11

Formulas are given for the distribution of waves in a laminated viscoelastic medium. Author (GRA)

N72-31935# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERCRITICAL DEFORMATION OF A CYLINDRICAL SHELL UNDER EXTERNAL PRESSURE
V. V. Mikhailov 29 Mar. 1972 8 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR (Kiev), no. 12, 1966 p 1545-1547
(AD-743337; FTD-HC-23-35-72) Avail: NTIS CSCL 13/13

The problem of determining lower critical pressure on a cylindrical shell under a constant external load is solved with the O. V. Pogorelov method. This method is based on a technique of approximating the mean surface shape of a shell during supercritical elastic equilibrium. First of all it is assumed that supercritical deformation is essentially a geometrical flexure. It is also assumed that supercritical deformation constitutes development of a form of wave generation on the surface of a shell at the moment of loss stability. Author (GRA)

N72-31936# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
STRAINS AND DISPLACEMENTS ON A STEEL WIRE STRAND
A. J. Durelli and S. Machida Mar. 1972 35 p refs
(Contract N00014-68-A-0506-0001)
(AD-742874; Rept-72-3-A) Avail: NTIS CSCL 13/9

There is a great industrial interest in the knowledge of the load transfer and the stress distribution in assembled wires making strands and in assembled strands making wire-ropes. The part of a large program that is reported in the paper deals with a 7-wire steel strand (six helical wires and a core) that is loaded axially, (with ends free to rotate and independently, with ends restricted from rotation) and in bending. Strains were determined using brittle coatings and electrical resistance strain gages and are compared with the results of a theoretical analysis previously published. The non-linear character of the phenomenon is emphasized. Author (GRA)

N72-31937# Aerospace Corp., El Segundo, Calif.
DELTA-C/DELTA-A CALIBRATION OF A CONTOURED CANTILEVERED BEAM SPECIMEN Technical Report, Jan. - Apr. 1971
Dennis L. Dull, James D. Buch, and Louis Raymond 15 Feb. 1972 32 p refs
(Contract F04701-71-C-0172)
(AD-742977; TR-0172(2250)-10)-6; SAMSO-TR-72-90) Avail: NTIS CSCL 20/11

The contoured double cantilever beam specimen is reexamined to determine the effect of rigid extensions of the cantilever arms. The relationships between the apparent compliance, measured on the extension arm, and the true compliance, measured at the load points, are determined experimentally and compared with corrections estimated from beam theory and a linear correction method. It is shown that the correction factors required are large and can only be adequately determined by direct experiment. Author (GRA)

N72-31938# Naval Research Lab., Washington, D.C.
CRITERIA FOR FRACTURE CONTROL PLANS
W. S. Pellini 11 May 1972 100 p refs
(AD-743058; NRL-7406) Avail: NTIS CSCL 11/6

The report presents interpretations of the significance of fracture-state criteria and their application in the development of rational fracture-control plans. A brief is evolved for meeting of regulatory and/or contractual requirements, based on scientific and technologically appropriate procedures. It is emphasized that the emerging issues of the 1970's center on technological application of fracture-control principles, in the total context of engineering realities and normal business relationships.
Author (GRA)

N72-31939# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BEHAVIOR OF CYLINDRICAL SHELLS UNDER THE INFLUENCE OF MOVING LOADS
A. S. Volmir, L. N. Dolgikh, E. D. Skurlatov, and V. R. Solonenko 7 Mar. 1972 8 p refs Transl. into ENGLISH from Tr. 7th Vsesoyuz noi Konf. po Teorii Obolochek i Plastinok (USSR),

1970 p 153-155
(AD-742709; FTD-HC-23-1806-71) Avail: NTIS CSCL 13/13

The authors discuss a closed cylindrical shell, articulately supported along its edges, which is subjected to the action of static longitudinal forces and pressure that is evenly distributed along its lateral surface. At the initial moment, the shell is struck by a compression wave having a flat front and exponentially changing pressure behind the front. Author (GRA)

N72-31940# Catholic Univ. of America, Washington, D.C. Stress Analysis Lab.
STRESSES AND STRAINS IN A DISK WITH VARIABLE MODULUS OF ELASTICITY
A. J. Durelli and S. Machida Mar. 1972 27 p refs
(Contract N00014-67-A-0377-0011)
(AD-744071; Rept-28) Avail: NTIS CSCL 11/10

A transparent material with variable modulus of elasticity has been manufactured. It exhibits good photoelastic properties, and can also be strain analyzed by printing gratings on its surface and producing the moire effect. The new material is used to stress and strain analyze a disk of variable E, subjected to diametral compression. The discussion of the results obtained suggests that the stress distribution in the disk of variable E is practically the same as the stress distribution in the homogeneous disk. It also indicates that the strain fields in both cases are very different, but that it is possible, approximately, to obtain the stress field from the strain field using the value of E at every point, and Hooke's law. Author (GRA)

N72-31941# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering. and Applied Mechanics.
TRANSIENT RESPONSE OF A POINT EXCITED SUBMERGED SPHERICAL SHELL
Y. K. Lou and J. M. Klosner May 1972 34 p refs
(Contract N00014-67-A-0438-0006; NR Proj. 064-427)
(AD-744020; PIBAL-72-17) Avail: NTIS CSCL 13/13

The transient responses of a submerged spherical shell to a concentrated impulse and Heaviside load are obtained by using the classical mode method and the Laplace transform. For long time solutions, only a relatively small number of modes are sufficient, while for the short time response, a large number of modes must be used in order to achieve acceptable accuracy. For the lower modes, the inversion integral involves only simple poles and can be evaluated by Cauchy's residue theorem. For the higher modes it is necessary to use asymptotic approximations and the inversion involves branch points and poles.
Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-31942*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INVESTIGATION OF THE IGNITION AND BURNING OF MATERIALS IN SPACE CABIN ATMOSPHERES. PART 1: IGNITION AND BURNING OF MATERIAL Final Report
H. G. Lew Mar. 1972 105 p refs
(Contract NASw-1874)
(NASA-CR-128068; GE-TIS-72SD2061-Pt-1) Avail: NTIS HC $7.25 CSCL 21B

An analytical study of the theory of ignition and burning of a plastic material immersed in an atmosphere of a space cabin which may be subjected to gravity force changes is considered. The hazardous condition in a space cabin environment where the changes of gravity may effect the combustion process is evaluated. The model considered the analysis of the coupled gas and solid phases and is based on the premise that material heating leads to the formation of pyrolysis gases from the decomposed solid which then react with the ambient oxidizer to further the combustion process. Moreover, free convection plays a dominant role in transporting these hot gases to the virgin material. A time-dependent study of the coupled gas-solid model as required for ignition processes with emphasis on the surface energy interchange of the gas and solid phases has been made. Detailed distribution of species composition and temperature patterns provide a spatial and time map of the evolving gases from the material combustion. Author

N72-31943*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INVESTIGATION OF THE IGNITION AND BURNING OF MATERIALS IN SPACE CABIN ATMOSPHERES. PART 2: IGNITION OF A COMBUSTIBLE MIXTURE BY A HOT BODY WITH THE EFFECTS OF GRAVITY Final Report
H. G. Lew Mar. 1972 35 p refs
(Contract NASw-1874)
(NASA-CR-128064; GE-TIS-72SD2061-Pt-2) Avail: NTIS HC $3.75 CSCL 21B

The ignition of a combustible gas mixture by a hot cylinder under the effect of a gravity field for steady state conditions is examined. For this purpose a horizontal cylinder is considered with gravity as a parameter together with a finite chemical reacting flow generated by free convection with the additional effect of diffusion. Both mass transfer and zero mass transfer cases are considered. By defining an ignition criterion the surface temperature and species are obtained from the analysis as a function of the gravity field. It is supposed that at the point of ignition the heat evolved in the gas is sufficiently high to attain a sustained combustion without any energy from the hot cylinder.
Author

N72-31944# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PERTURBATION THEORY FOR THE THERMODYNAMIC PROPERTIES OF SIMPLE LIQUIDS
Loup Verlet and Jean-Jacques Weis May 1972 23 p refs
(LPTHE-72/17) Avail: NTIS HC $3.25

A critical discussion of the perturbation theory of simple liquids is presented. The unperturbed system is identified with hard spheres whose diameter is determined by a self-consistency requirement. The thermodynamics of the system, including the first-order contribution, can be computed analytically. The equation of state thus obtained was used to discuss experimental results for nonpolar liquids. Author

N72-31945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL SOLUTION FOR HEAT TRANSFER IN THREE-DIMENSIONAL POROUS MEDIA INCLUDING VARIABLE FLUID PROPERTIES
Robert Siegel and Marvin E. Goldstein Washington Sep. 1972 32 p refs
(NASA-TN-D-6941; E-6874) Avail: NTIS HC $3.00 CSCL 20M

An analytical solution is obtained for flow and heat transfer in a three-dimensional porous medium. Coolant from a reservoir at constant pressure and temperature enters one portion of the boundary of the medium and exits through another portion of the boundary which is at a specified uniform temperature and uniform pressure. The variation with temperature of coolant density and viscosity are both taken into account. A general solution is found that provides the temperature distribution in the medium and the mass and heat fluxes along the portion of the surface through which the coolant is exiting. Author

N72-31946*# TRW Systems, Redondo Beach, Calif.
EVALUATION OF THERMAL NETWORK CORRECTION PROGRAM USING TEST TEMPERATURE DATA
T. Ishimoto and L. C. Fink Jan. 1972 108 p refs
(Contract NAS9-10435)
(NASA-CR-128530; TRW-14690-6001-R0-00) Avail: NTIS HC $7.50 CSCL 20M

An evaluation process to determine the accuracy of a computer program for thermal network correction is discussed. The evaluation is required since factors such as inaccuracies of temperatures, insufficient number of temperature points over a specified time period, lack of one-to-one correlation between temperature sensor and nodal locations, and incomplete temperature measurements are not present in the computer-generated information. The mathematical models used in the evaluation are those that describe a physical system composed of both a conventional and a heat pipe platform. A description of the models used, the results of the evaluation of the thermal network correction, and input instructions for the thermal network correction program are presented. Author

N72-31947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXYGEN-HYDROGEN INJECTOR PERFORMANCE AND COMPATIBILITY WITH ABLATIVE CHAMBERS
John P. Wanhainen Washington Sep. 1972 29 p refs
(NASA-TM-X-2615; E-6926) Avail: NTIS HC $3.00 CSCL 21H

An experimental investigation was conducted to develop a high-thrust, high-performance, concentric tube injector element for use with near liquid hydrogen and liquid oxygen propellants. A parallel tube coaxial injector yielded 98 percent theoretical characteristic exhaust velocity efficiency. Installation of swirlers in the oxidizer tube improved performance but caused high ablative erosion near the injector. Film cooling significantly reduced ablative erosion near the injector but did not completely alleviate gouging adjacent to each outer injection element. Author

N72-31948*# Tulane Univ., New Orleans, La.
EXPERIMENTAL DETERMINATION OF THE TURBULENCE IN A LIQUID ROCKET COMBUSTION CHAMBER
J. Hara, L. O. Smith, and F. P. Partus Aug. 1972 47 p refs
(Grant NGR-19-002-030)
(NASA-CR-120977) Avail: NTIS HC $4.50 CSCL 21B

The intensity of turbulence and the Lagrangian correlation coefficient for a liquid rocket combustion chamber were determined experimentally using the tracer gas diffusion method. The results indicate that the turbulent diffusion process can be adequately modeled by the one-dimensional Taylor theory; however, the numerical values show significant disagreement with previously accepted values. The intensity of turbulence is higher by a factor of about two, while the Lagrangian correlation coefficient which was assumed to be unity in the past is much less than unity. Author

N72-31949# Technische Univ., Berlin (West Germany).
THE EFFECT OF STEAM- AND CONDENSATION FLOW ON HEAT TRANSFER AND PRESSURE LOSS IN STREAMING SATURATED VAPOR FLOW ON HORIZONTAL PIPE BUNDLES DURING FILM CONDENSATION Ph.D. Thesis [UEBER DEN EINFLUSS DER DAMPF UND KONDENSATSTROEMUNG AUF WAERMEUEBERGANG UND DRUCKVERLUSTE BEI DER FILMKONDENSATION STROEMENDEN SATTDAMPFES AN WAAGERECHTEN ROHRBUENDELN]
Klaus Turek 1971 114 p refs In GERMAN
Avail: NTIS HC $7.75

Heat transfer coefficients and pressure losses during condensation of vapor flow in horizontal condensers are analyzed for effects of heat flux density, forces produced by the heat flow, normalized condensate flow, and for the share of condensate flow in the mass flow of the vapor chamber. It is shown that pressure loss during condensation in horizontal tube bundles depends on the heat transfer coefficient; the Nusselt dependence of the heat transfer coefficient on heat flux density or forced temperature difference was not confirmed for steam heat transfer coefficients in the first pipe rows of the condenser. Transl. by G.G.

N72-31950# Technische Univ., Berlin (West Germany).
THE HEAT TRANSFER DURING STEAM CONDENSATION ON PIPE BUNDLES CONSIDERING PRESSURE LOSS Ph.D. Thesis [DER WAERMEUEBERGANG BEI DER KONDENSATION VON BERUECKSICHTIGUNG DES DRUCKVERLUSTES]
Manfred Dornieden 1971 109 p refs In GERMAN
Avail: NTIS HC $7.50

Effects of pipe bundle geometry, material properties, and service times on the course of saturated vapor temperature are discussed in order to minimize construction costs for a pipe bundle condenser. A differential equation is formulated for the case that the condensing vapor flowing through the tube bundle undergoes pressure loss and thus effects the heat transfer. Transl. by G.G.

N72-31951# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
DIFFERENTIATION POSSIBILITIES OF COMMERCIAL EXPLOSIVES IN VIEW OF THEIR EFFECT ON THE ENVIRONMENT [DIFFERENZIERUNGSMOEGLICHKEITEN BEI GEWERBLICHEN SPRENGSTOFFEN HINSICHTLICH IHRER WIRKUNG AUF DIE UMGEBUNG]
H. Pfoertner 31 Dec. 1971 30 p refs In GERMAN
(ICT-13/71) Avail: NTIS HC $3.50

The pressure distribution function of explosive detonations was calculated with known equations in order to evaluate the effects of a given explosive on the environment and to determine the safe distance as a function of the amount of explosive. An adaptation of the model for mining safety explosives is proposed. ESRO

N72-31952# Institut Franco-Allemand de Recherches, St. Louis (France).
CALCULATION OF THE DETONATION OF AN EXPLOSIVE CHARGE IN A TUNNEL, PART 1 [CALCUL DE LA DETONATION D'UNE CHARGE EXPLOSIVE DANS UN TUNNEL, PREMIERE PARTIE]
F. Verdier and F. Wecken 5 Jan. 1972 36 p refs In FRENCH
(Contract DTEN-71.70.181)
(ISL-1/72) Avail: NTIS HC $4.00

The propagation of a detonation wave generated by a conical explosive charge with section inferior to tube or tunnel section is considered. A computational method is presented based on the calculation of chemical and thermal equilibria of detonable gas mixtures, assuming that the gas mixtures behave as a perfect gas. Numerical examples are presented for four tolamite charge densities. ESRO

N72-31953# Army Foreign Science and Technology Center, Charlottesville, Va.
THE NONSTATIONARY TEMPERATURE FIELDS OF THE WALL OF A PIPE AND THE HEAT CARRIER FOR SMALL VALUES OF THE Bi CRITERION
B. M. Galitseiskii and G. A. Dreitser 27 Sep. 1971 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), no. 2, 1970 p 90-98
(AD-743043; FSTC-HT-23-15-72) Avail: NTIS CSCL 20/13

The authors discuss the nonstationary heat exchange process in a pipe in the case when the heat transfer coefficient of the heat carrier is known. Author (GRA)

N72-31954# McDonnell-Douglas Co., St. Louis, Mo.
ADVANCED FLAME ARRESTOR MATERIALS AND TECHNIQUES FOR FUEL TANK PROTECTION— Final

Technical Report, 28 Dec. 1970 - 26 Nov. 1971
Quentin C. Malmberg and Edwin W. Wiggins Mar. 1972 160 p refs
(Contract F33615-71-C-1191)
(AD-743016; AFAPL-TR-72-12) Avail: NTIS CSCL 13/12

Fuel tank fires and explosions are a major cause of aircraft losses in combat. Considerable research and development has been devoted to exploring fuel tank explosion protection concepts. Nitrogen dilution, chemical quenching and polyurethane foam void filler material emerge as the primary candidate systems. Of these the passive, logistics free polyurethane foam systems appears ideal. Research was conducted to improve and optimize installation concepts and techniques for foam fire and explosion suppression in simulated aircraft fuselage and wing fuel tanks. Configurations designed to accomplish these program objectives were established to provide data that would optimize the system operation from a foam void standpoint. Next material flame arrestor effectiveness was investigated with respect to combustion over-pressure and fuel flow resistance. Thermophysical properties determinations of candidate arrestor materials were conducted. Data of the program were reduced and collated. GRA

N72-31955# Army Foreign Science and Technology Center, Charlottesville, Va.
CALCULATION OF THERMAL PROCESS IN A RECTANGULAR PARALLELEPIPED AND IN A SOLID CYLINDER FOR A TIME DEPENDENT AMPIENT TEMPERATURE
W. Reiss 18 Jan. 1972 12 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 19, Sep. 1970 p 508-513
(AD-743020; FSTC-HT-23-1474-71) Avail: NTIS CSCL 20/13

A method is given for calculating temperature variation on the basis of an exact solution of the heat conductivity equation under the assumption of Newton's law of cooling. The temperature of the ambient medium is approximated by a piecewise linear time function. Author (GRA)

N72-31956# Army Foreign Science and Technology Center, Charlottesville, Va.
A PROBLEM OF HEAT TRANSFER OF NON-FOURIER ANOMALOUSLY VISCOUS LIQUIDS
B. M. Berkovskii, Z. P. Shulman, and N. D. Kovalevskaya 28 Apr. 1972 19 p refs Transl. into ENGLISH from the publ. "Teplo: I Massobmen v Nenyutonovskikh Zhidkostyakh" Moscow, Energia, 1968
(AD-743360; FSTC-HT-23-204-72) Avail: NTIS CSCL 20/13

The object of the study was the convective heat exchange of abnormally viscous non Newtonian liquids in two dimensional boundary layer. It is assumed that the viscosity and heat conductivity are exponential functions of the second invariant of the speed tensor deformation. Precise automodel solutions corresponding to plane boundary layers have been obtained and are evaluated. The influence of non Newtonian properties of liquids on friction and heat exchange is analyzed. Author (GRA)

N72-31957# Safety in Mines Research Establishment, Buxton (England).
THE MECHANISM OF FLAMEPROOF PROTECTION
H. Phillips 1971 85 p refs
(PB-208676; SMRE-RR-275) Avail: NTIS HC $3.00 CSCL 21B

The initiation of external flame by the jet of hot gases ejected from the flange gap in a flameproof enclosure depends on two factors; heat transfer in the gap cools the gases, and entrainment of fresh gas into the jet supplies fuel for combustion. Whether ignition occurs depends on the extent of the cooling, the rate of entrainment of fresh gas into the jet, and the rate at which gas in the jet can burn. This simple model has been used to calculate the size of the maximum experimental safe gap under a variety of experimental conditions and in all the cases tested there was good agreement with the experimental result. Author (GRA)

N72-31958# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Applied Chemistry.
ON THE NATURE, PROPERTIES, AND BEHAVIOUR OF BUSH-FIRE SMOKE
R. G. Vines, L. Gibson, A. B. Hatch, N. K. King, D. A. MacArthur, D. R. Packham, and R. J. Taylor 1971 33 p refs
(PB-208113; Tech-Paper-1) Avail: NTIS HC $3.00 CSCL 21B

Smoke particles from a series of large-scale prescribed fires have been collected in equipment aboard a light aircraft and analysed for mineral ash, tar, and other carbonaceous components. The approximate size of the smoke particles was also determined. Concentrations of various gases in the smoke have been estimated (carbon dioxide, carbon monoxide, sulphur dioxide, ammonia, olefins, oxides of nitrogen, and ozone). Diffusion properties of the smoke have also been studied and information is provided about turbulent diffusion coefficients in the smoke. Author (GRA)

N72-31959# New Mexico Univ., Albuquerque.
A STUDY OF OPTIMUM WICK DESIGN IN WATER HEAT PIPES Annual Report
K. T. Feldman, Jr. Feb. 1972 28 p refs
(Contract N00014-68-A-0155)
(AD-744031; ME-54(72)ONR-012) Avail: NTIS CSCL 13/1

Contents: Analytical study of evaporation from grooves; Experimental study of evaporation from grooves; and Study of evaporation from screens. GRA

N72-31960# Army Foreign Science and Technology Center, Charlottesville, Va.
DETERMINING MEAN HEAT TRANSFER COEFFICIENTS WITH BUILT IN ALPHACALORIMETERS
V. M. Kapinos, V. N. Pustovalov, and A. P. Rudko 1972 12 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 19, no. 2, 1970 p 236-242
(AD-741525; FSTC-HT-23-735-72) Avail: NTIS CSCL 20/13

An approximate method is described for determining the mean heat transfer coefficient ahead of a built in alphacalorimeter from the data of temperature measurements on the surface and by measuring the local coefficient of heat transfer and the local rate of flow at the point at which the alphacalorimeter is installed. Author (GRA)

N72-31975* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SMALL ROCKET EXHAUST PLUME DATA
J. E. Chirivella, P. I. Moynihan, and W. Simon *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 90-99 refs (For availability see N72-31964 22-34)
CSCL 21B

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-31961 Council for Scientific and Industrial Research, Pretoria (South Africa).
SCIENTIFIC AND INDUSTRIAL RESEARCH Annual Report, 1 Jan. - 31 Dec. 1971
1972 82 p refs
(CSIR-27) Avail: Issuing Activity

The research accomplished by the Council for Scientific and Industrial Research is reported for 1971. Areas in which developments are reported include chemistry, physics, geomagnetism, astronomy, mathematical sciences, telecommunications, mechanical engineering, electrical engineering, water research, air pollution, timber research and textiles. F.O.S.

N72-31962# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
[AEROSPACE RESEARCH AND ENGINEERING ACTIVITIES, 1971]
Jun. 1972 176 p refs In FRENCH; partly in ENGLISH
Avail: NTIS HC $11.00

The activities of ONERA are reported for 1971. Developments in the following areas are included: contract financing, aerodynamics, wind tunnels, flow measurement, materials, patents, and space technology. F.O.S.

N72-31963# Committee on Science and Astronautics (U. S. House).
FEASIBILITY STUDY OF AN AEROSPACE MUSEUM IN THE WESTERN UNITED STATES
Washington GPO 1972 612 p refs Presented to the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 31 Jul. 1972 Prepared under NASA contract by the Smithsonian Inst. Natl. Air and Space Museum
Avail: SOD $2.75

Existing aerospace museums in the whole U.S. were surveyed, and the feasibility of establishing an aerospace museum in the western U.S. was investigated. Widespread interest in aerospace activities was noted throughout the western U.S., and 16 museums were found to exist in California, 3 in Washington, 3 in Arizona, and 1 each in Colorado, New Mexico, Oregon, and Utah. It is recommended that prime consideration should be given to the development of existing museums rather than the establishment of a new major museum. If it is decided to establish a single new museum, the proposal by the California Museum of Science and Industry at Los Angeles is considered the best investment. Other possibilities are also discussed. A regional location analysis indicates that Los Angeles has the greatest potential for a museum, with San Francisco, San Diego, Seattle, and Phoenix/Tucson following in that order. N.E.N.

N72-31964*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL QUARTERLY TECHNICAL REVIEW, VOLUME 2, NO. 2, JULY 1972
Jul. 1972 247 p refs
(Contract NAS7-100)
(NASA-CR-128063) Avail: NTIS HC $14.50; JPL, Manager, Tech. Inform. and Documentation Div. Support Sect. 651 CSCL 05B

Research is reported for the following areas: materials, orbits and trajectories, planetary atmospheres, spacecraft propulsion, radiation shielding, solid state physics, spacecraft antennas, and wave propagation. Included is an annotated bibliography containing 284 literature citations. For individual titles, see N72-31965 through N72-31976.

N72-31965* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODELS FOR THE ATMOSPHERES OF JUPITER AND SATURN **c30**
N. Divine and F. D. Palluconi *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 1-8 refs (For availability see N72-31964 22-34)
CSCL 03B

Numerical models of the atmospheres of Jupiter and Saturn have been created for use in the development of design criteria for space vehicles intended to investigate these plants. These models provide a basis for the assessment of entry heating, the transmission and emission of radiation, and structural and aerodynamic interactions. The model atmospheres are based on data and analyses published in the literature through 1970. The composition is duscussed, and the relative amounts of each molecular species are tabulated for nominal and extreme cases. The structure of the atmospheric regions is discussed, and the principal features of one nominal and two limiting models for each planet are indicated. The models are illustrated by pressure-temperature profiles which also display the major cloud layers. Author

N72-31966* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AIMING STRATEGIES FOR QUARANTINED MULTIPLANET MISSIONS **c30**
N. P. Dwivedi *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 9-17 ref (For availability see N72-31964 22-34)
CSCL 22A

An important flight path constraint for current and future interplanetary missions arises from planetary quarantine restrictions. Each planet is assigned a maximum allowable probability of contamination which must not be violated. A portion of this probability is suballocated among the trajectory correction maneuvers. The remaining portion is allocated to the small ejecta/efflux sources released from the spacecraft that could possibly reach the planetary atmsophere and surface. For each maneuver, the suballocation is translated into an allowable probability of planetary impact. At the time of making a maneuver, the allowable probability of impact may dictate biasing the aim point. This study describes the technique of determining preferred biased aim points, given the suballocated probability of contamination for each maneuver. Author

N72-31967* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION SIGNAL POWER MEASUREMENT **c07**
R. Winkelstein *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 18-24 ref (For availability see N72-31964 22-34)
CSCL 17B

Accurate estimation of signal power is an important Deep Space Network (DSN) consideration. Ultimately, spacecraft power and weight is saved if no reserve transmitter power is needed to compensate for inaccurate measurements. Spectral measurement of the received signal has proved to be an effective method of estimating signal power over a wide dynamic range. Furthermore, on-line spectral measurements provide an important diagnostic tool for examining spacecraft anomalies. Prototype equipment installed at a 64-m-diameter antenna site has been successfully used to make measurements of carrier power and sideband symmetry of telemetry signals received from the Mariner Mars 1971 spacecraft. Author

N72-31968* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE RESPONSE OF A 0.03-cm SILICON DETECTOR TO A MIXED NEUTRON AND GAMMA FIELD AS A FUNCTION OF SHIELD MATERIAL AND THICKNESS **c09**
M. Taherzadeh *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 25-41 refs (For availability see N72-31964 22-34)
CSCL 09E

The neutron and gamma radiation from a MHW-RTG was used to evaluate the total response of a shielded 0.3-mm silicon detector. The generator employs a 2200 W(th) PuO2 heat source concept known as the HELIPAK. The total integrated neutron and gamma ray fluxes at 100 cm away from the source along the radial direction were 1.67 x 1,000 n/sq cm/s and 1.49 x 10,000 gamma sq cm/s, respectively. Experimental values of the response function of the shielded silicon detector were used to determine the total counting rates due to photons at bias energies ranging from 50 to 200 keV. For neutrons, analytically computed response functions were used to determine the total counting rates at the same bias energies. It was found that for an aluminum shield the neutrons are not significant, regardless of the thickness of the shield. However, the magnitude of the total counting rate due to neutrons increases with increased atomic number of the shield and becomes comparable to the counting rate due to photons for a platinum shield thickness of 5 cm. Author

N72-31969* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LARGE SPACECRAFT ANTENNAS: CONICAL RING-MEMBRANE REFLECTORS **c09**
R. E. Oliver, M. R. Trubert, and A. H. Wilson *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 42-47 refs (For availability see N72-31964 22-34)
CSCL 17B

A 1.83-m diameter furlable conical Gregorian antenna

based on a novel spoke-supported ring-membrane concept has been successfully demonstrated. Mechanical measurements of the conical reflecting surface, as well as BE gain measurements at Ku-band, show an rms surface deviation from the proper conical surface of 0.3 mm and a repeatability after multiple furling-unfurling cycles of + or - 0.05 mm. Design features and performance characteristics of this antenna indicate that the spoke-supported ring-membrane concept is a promising approach for producing large, furlable, lightweight, conical reflectors for spacecraft high-gain antennas. Author

N72-31970* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE ELASTIC PROPERTIES OF FIBER COMPOSITE LAMINATES WITH STATISTICALLY DISPERSED PLY ORIENTATIONS **c18**
E. Y. Robinson *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 48-60 refs (For availability see N72-31964 22-34)
CSCL 11P

Structural application of advanced composite filamentary materials requires lamination of the basic orthotropic plies into angle-ply laminates. The resulting elastic and strength properties depend on the pattern of orientation and are influenced by inevitable errors and inaccuracy in placement of the angle plies. Reviewed is the effect on elastic properties of orientation dispersion. The conventional constitutive relations are recast in a homologous form to account for orientation dispersion by addition of a single parameter. Graphical results are presented to show the behavior of the most important advanced composite materials. The results are directly useful for estimating effects of manufacturing inaccuracy and for design of partially oriented reinforced structures. Author

N72-31971* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT ION BEAM NOISE EFFECTS **c07**
G. L. Anenberg *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 61-71 refs (For availability see N72-31964 22-34)
CSCL 17B

An estimate of the antenna noise temperature and the uplink signal-to-noise ratio has been made for Bremsstrahlung radiation emitted by a spacecraft ion beam; a worst-case situation in which the spacecraft antenna is located in the exit plane of the ion beam and directed at varying angles into the ion beam is assumed. Numerical results of the antenna noise temperature versus antenna pointing angle are given for a typical set of ion beam and antenna pattern parameters. The uplink signal-to-noise ratio due to the ion beam noise alone is given in terms of a critical range in AU at which a typical ranging transmission is received with S/N = 0 db. The effects of the ion beam divergence angle and antenna distance on the ion beam are also presented. Results of the study show typical increases in the antenna noise temperature of about 0.2 K and critical ranges of the order of 3-5 AU. An ion engine thus generally introduces an undetectable level of noise into a spacecraft receiver. Author

N72-31972* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL NOISE IN SPACE-CHARGE-LIMITED HOLE CURRENT IN SILICON **c26**
A. Shumka, J. Golder, and M.-A. Nicolet *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 72-76 refs (For availability see N72-31964 22-34)
CSCL 20L

Present theories on noise in single-carrier space-charge-limited currents in solids have not been quantitatively substantiated by experimental evidence. To obtain such experimental verification, the noise in specially fabricated silicon structures is being measured and analyzed. The first results of this verification effort are reported. Author

N72-31973* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LONG-TERM STORAGE TEST OF A SYNCOM SOLID ROCKET MOTOR **c27**
R. L. Ray *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 77-82 ref (For availability see N72-31964 22-34)
CSCL 21I

After 7.5 years of storage at ambient temperature, a solid propellant apogee motor was tested successfully. The performance of the motor did not deteriorate as a result of prolonged storage. Tabular performance data and graphic thrust and pressure variations are given. Author

N72-31974* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUPERCONDUCTIVITY IN THE ALKALI METAL INTERCALATES OF MOLYBDENUM DISULPHIDE **c26**
R. B. Somoano, V. Hadek, and A. Rembaum *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 83-89 refs (For availability see N72-31964 22-34)
CSCL 20L

The complete series of alkali metals, lithium through cesium, have been intercalated into molybdenum disulphide, using both the liquid ammonia and vapor techniques. All the intercalates with the exception of lithium yielded full superconducting transitions with onset temperatures of 6 K for AxMoS2(Ax = K, Rb,Cs) and 4 K for BxMoS2(Bx = Li,Na). The superconducting transition for lithium was incomplete down to 1.5 K. Stoichiometries and unit cell parameters have been determined for the intercalation compounds. Both rhombohedral and hexagonal polymorphs of MoS2 have been intercalated and found to exhibit the same superconductivity behavior. The nature of the extraneous superconducting transition of some intercalated samples on exposure to air was elucidated. Author

N72-31975* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SMALL ROCKET EXHAUST PLUME DATA **c33**
J. E. Chirivella, P. I. Moynihan, and W. Simon *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 90-99 refs (For availability see N72-31964 22-34)
CSCL 21B

During recent cryodeposit tests with an 0.18-N thruster, the mass flux in the plume back field was measured for the first time for nitrogen, carbon dioxide, and a mixture of nitrogen, hydrogen, and ammonia at various inlet pressures. This mixture simulated gases that would be generated by a hydrazine plenum attitude propulsion system. The measurements furnish a base upon which to build a mathematical model of plume back flow that will be used in predicting the mass distribution in the boundary region of other plumes. The results are analyzed and compared with existing analytical predictions. Author

N72-31976* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR-ELECTRIC PROPULSION BREADBOARD THRUST SUBSYSTEM **c28**
T. D. Masek *In its* JPL Quart. Tech. Rev., Vol. 2, No. 2 Jul. 1972 p 100-112 refs (For availability see N72-31964 22-34)
CSCL 21C

A solar-electric propulsion breadboard thrust subsystem has been designed, built, and tested. A 1500-h test was performed to demonstrate the functional capabilities of the subsystem. Described are the subsystem functions and testing process. The results show that the ground work has been established for development of an engineering model of the thrust subsystem. Author

N72-31977# Committee on Appropriations (U. S. House).
HUD-SPACE-SCIENCE-VETERANS APPROPRIATIONS FOR 1973, PART 2
Washington GPO 1972 1303 p refs Hearings before Comm. on Appropriations, 92d Congr., 2d Sess., Mar. 1972
Avail: Subcomm. on HUD-Space-Sci.-Veterans.

Congressional appropriations hearings for the Housing and Urban Development Program for Space, Science, and Veterans are reported. Contributions of the savings and loan industry to the housing program are described and 1973 fiscal goals are outlined. G.G.

N72-31978# Office of Telecommunications Policy, Washington, D.C.
ACTIVITIES AND ACCOMPLISHMENTS UNDER THE COMMUNICATIONS SATELLITE ACT OF 1962 Annual Report, 1 Jan. - 31 Dec. 1970
31 Dec. 1970 23 p
Avail: NTIS HC $3.25

The accomplishments and activities under the Communications Satellite Act of 1960 are outlined. Data cover efforts made to establish a global satellite communications system, improved international service, and the commercial applications of the satellite system. Data are also given for world radio interference and propagation programs and satellite operational capabilities. E.H.W.

N72-31979# Naval Research Lab., Washington, D.C.
NRL PROGRESS REPORT, JULY 1972
Jul. 1972 57 p refs
Avail: NTIS HC $5.00

The basic properties of surface acoustic waves are discussed along with various methods for generation, conversion, and detection. Interactions between acoustic waves and optical and microwave electromagnetic waves are described. The unique properties of surface acoustic wave devices and techniques in frequency filtering and phase-coded, FM, and nonlinear signal processing are summarized. Progress notes on projects of the research and development program are also presented, and include work on the following: an extended-range hydrophone, fire suppressors, broadband directional coupler, elastic constants of single crystal indium, low energy electron impact rate coefficients for atmospheric species, radar arrays, search radar systems, lunar surface oxidation, relative motion of orbiting satellites, pulse position determination, applications of mathematics, and metallurgical developments. N.E.N.

N72-31980# Joint Publications Research Service, Arlington, Va.
STATE FIVE-YEAR PLAN FOR THE DEVELOPMENT OF THE USSR NATIONAL ECONOMY FOR THE PERIOD 1971-1975, PART 1
N. K. Baybakov, ed. 7 Sep. 1972 229 p Transl. into ENGLISH of the book "Gosudarstvennyy Pyatiletniy Plan Razvitiya Narodnogo Khozyaystva SSSR na 1971-1975 Gody" Moscow, State Publishing House for Political Lit., 1972 455 p
(JPRS-56970-1-Pt-1) Avail: NTIS HC $13.50

Statistics were compiled on all aspects of the USSR national economy, including data on population, national production, the labor force, industry, agriculture, transportation, communications, foreign and domestic trade, housing and income broken down by geographic area and economic sectors. Author

N72-31981# Joint Publications Research Service, Arlington, Va.
STATE FIVE-YEAR PLAN FOR THE DEVELOPMENT OF THE USSR NATIONAL ECONOMY FOR THE PERIOD 1971-1975, PART 2
N. K. Baybakov, ed. 7 Sep. 1972 247 p Transl. into ENGLISH of the book "Gosudarstvennyy Pyatiletniy Plan Razvitiya Narodnogo Khozyaystva SSSR na 1971-1975 Gody" Moscow, State Publishing House for Political Lit., 1972 455 p
(JPRS-56970-2-Pt-2) Avail: NTIS HC $14.50

Statistics are compiled on all aspects of the USSR national economy, including data on population, national production, the labor force, industry, agriculture, transportation, communications, foreign and domestic trade, housing and income broken down by geographic area and economic sectors. Author

N72-31982# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHIELDING OF A METAL SURFACE BY RUPTURE PRODUCTS (96)
S. I. Anisimov, Ia. A. Imas, G. S. Romanov, and Iu. V. Khodyko 1970 21 p refs Transl. into ENGLISH from the book "Deistvie Izlucheniia Bolshoi Moshchnosti na Metally" Moscow, Nauka, 1970 p 152-163
Avail: NTIS HC $3.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The topics discussed include: (1) shielding of a metal surface by rupture products, (2) limits of applicability of gas dynamic solutions in adiabatic approximation, (3) existence conditions for expansion flow at an evaporating surface, with equilibrium condensation, (4) flow stability in condensation shock, (5) deviation from ionization equilibrium in an expanding vapor, and (6) influence of nonequilibrium of electron processes on vapor absorptivity. K.P.D.

N72-31983# Committee on Interior and Insular Affairs (U. S. Senate).
REDESIGNATE CAPE KENNEDY AS CAPE CANAVERAL
Washington GPO 1972 53 p refs Hearing on S.J. Res. 193 before Comm. on Interior and Insular Affaris, 92d Congr., 2d Sess., 8 Mar. 1972
Avail: Comm. on Interior and Insular Affairs

Hearings before the Senate Committee are presented and include statements made in person, communications, resolutions, and editorials. The statements are almost all from Floridians and in favor of the name Cape Canaveral. N.E.N.

N72-31984# Nauka Press, Moscow (USSR).
THE POTENTIAL FUNCTION METHOD IN THE THEORY OF MACHINE LEARNING
M. A. Ayzerman, E. M. Braverman, and L. I. Rozonoer 1970 383 p refs In RUSSIAN
Avail: NTIS HC $21.25

Contemporary directions in cybernetics are considered, in connection with modeling learning processes on computers. Developments in the method of potential functions and its use in problems of pattern recognition, identification, and automatic classification are discussed. The major attention is devoted to mathematical problems, concerned with convergence of random processes, and arising from the application of the method, and its connection with other methods of learning theory (in particular, with methods of stochastic approximation). Transl. by K.P.D.

N72-31985# New South Wales Univ., Kensington (Australia).
RESEARCH AND PUBLICATIONS, 1971: UNIVERSITY OF NEW SOUTH WALES
Jun. 1972 194 p refs
(Q378.94405) Avail: NTIS HC $11.75

Research and publications of the various faculties of the University of New South Wales, Wollongong University College, and W. S. and L. B. Robinson University College are reported. The faculties include applied science, architecture, arts, commerce, engineering, medicine, military studies, and science (physics, chemistry, and mathematics), as well as education and vocational studies. N.E.N.

N72-31986# Joint Publications Research Service, Arlington, Va.
LABOR IN THE SPHERE OF SCIENCE
P. N. Zavlin, A. I. Shcherbakov, and M. A. Yudelevich 5 Sep. 1972 338 p refs Transl. into ENGLISH of the book "Trud v Sfere Nauki" Science Publishing House, Novosibirsk, 1971 392 p
(JPRS-56945) Avail: NTIS HC $19.00

Science and the social division of labor, the relationship between science and production, and organization of labor in the sphere of science are discussed. The further improvement of the organization of labor and associated problems in the establishment of work norms are also examined. Author

N72-31987# Interior Dept., Washington, D.C. Office of Library Services.
READINGS FOR THE ECO-ACTIVIST: A BIBLIOGRAPHY OF SELECTED ENVIRONMENTAL PUBLICATIONS OF THE EXECUTIVE BRANCH OF THE FEDERAL GOVERNMENT, SECOND EDITION
Apr. 1972 48 p refs
(PB-208943) Avail: NTIS HC $3.00 CSCL 13B

Contents: overview, weather modification, water resources, power, land use and improvement, parks and recreation, wildlife, pollution abatement, air pollution, water pollution, noise pollution, pesticides and other toxic substances, waste management, radiation, urban environmental, and teaching aids. GRA

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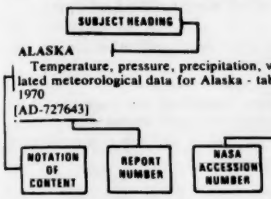

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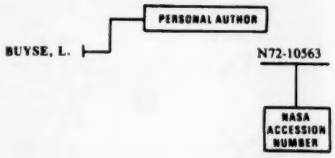

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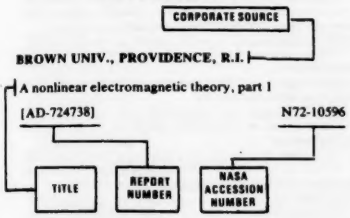

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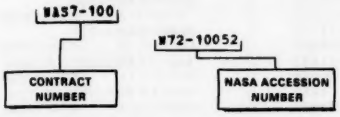

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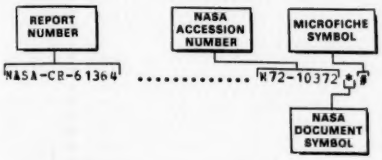

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